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## British Association.

### SOME ASPECTS OF THE FUTURE OF THE SYNTHETIC CHEMICAL INDUSTRY OF GREAT BRITAIN.

Address delivered at the British Association (Section B), Newcastle Meeting, 1916.

BY FRANCIS H. CARR.

Since the outbreak of war we have read and listened to much concerning the question how to assist the development of British chemical industry, and nearly all that we have read and heard as to the need of co-operation in both research and industry, and their systematic organisation in matters financial, manufacturing, and educational, has met with our approval. Over and over again we have been urged to take resolute action—as, indeed, we were, also, from time to time before the war. Already, not a few of us are getting very weary of these discussions and are determined to replace them by immediate action.

What has been said of the British chemical industry in general applies with special force to the synthetic chemical branch, with which I propose to deal. As I wish to refrain, if possible, from the repetition referred to, will you please excuse me from attempting to give any complete survey of the future prospects of this branch and allow me to deal with the educational aspect of the matter, which, after all, may be the one of which you are weariest? It must be because I am not an educationalist that I am bold enough to come before men who are so qualified, and make fresh and heterodox proposals for which a teacher of chemistry might incur severe chastisement at your hands. However, if one may proceed, let it be assumed that we understand approximately the present position of the synthetic chemical industry, and how we have been led during the war to manufacture many dyes and medicinal chemicals in addition to those which were previously made here. Of many of these substances the demand (generally created by Germans) had by that time, and in most cases long previously, become an imperative need. It is equally understood that this great need and the enormous increase in prices resulting therefrom have temporarily opened the way to the manufacture of many dyes and medicinal and photographic chemicals not hitherto made here. Probably we are agreed, also, as to the need of taking steps to protect the industry from destruction by foreign competition during the early years after the war, and as to that of establishing it ultimately without dependence upon any form of protective measures—for, in the long run, scientific efficiency must determine which nation shall retain an industry. What, then, are the conditions required to make the synthetic chemical branch of the industry flourish and expand in Great Britain?

The manufacture of synthetic chemicals is, perhaps, peculiar among manufactures in one respect. A very great diversity of operations involving expert knowledge has to be carried out in the preparation of any one compound, and, with but few exceptions, the demand for any one such substance is so small that, for economic reasons, its manufacture cannot be carried on continuously all the year round. The diversity of functions

required of workers and organisation must therefore be still further extended by the making now of one compound, now of quite a different one. In addition to being various, the operations, as already indicated, are often difficult, requiring skill and experience, lack of which on the part of the workman may entail heavy losses.

We are generally agreed, no doubt, that this diversity makes co-operation between manufacturers a fundamental necessity, so that intermediate products required for several manufactures may be made economically, and therefore on the largest possible scale, and without unnecessary overlapping. But I wish to focus attention upon the type of men required to carry on and direct such manufactures, and to point out that if our educational provisions for supplying suitable men were less haphazard it would be greatly to the advantage of chemical manufacture in Great Britain. At the same time, it must be admitted that the prospects of those embarking on a chemical career are not as alluring as they might or ought to be.

The works chemist is not a greatly envied man as is, say, a medical practitioner, a barrister-at-law, or a civil engineer, yet he should have at least as lengthy an education as any of these. The industry needs more men of ability, character, and courage, and to get them we must improve the position both as regards scientific recognition and remuneration. The latter should be liberal enough, not only to attract men of first-rate ability to the industry, but to retain them on its technical side. It is anomalous that a man's earning capacity should generally be considered distinctly greater in commercial than in technical occupations; the anomaly unfortunately exists, and is responsible for a good many deliberate desertions of the technical for the commercial side of a business. A more general adoption of systems of partial payment by results would not only benefit both employer and employed, but would have far-reaching effects upon the whole industry by stimulating men to greater effort and inducing them to remain at their technical work. Scientifically trained people would do well when accepting engagements to stipulate for some scheme of participation in the fruitfulness of their work. Such schemes have worked well for both parties in the chemical industry on the Continent, and have been a material factor in its progress.

Let it be granted, then, that the chemical industry is in need of specially trained workers—a position which, after all, is true of many industries. By what process ought they to be prepared? In the college, in the factory, or in both? Most of us will agree that it must be by the last-mentioned combination—that neither college nor factory can alone complete the training; but as to the details of the functions to be performed by the two there is greater room for difference of opinion.

At this stage we need to discriminate between two classes of workers, namely (1) technical and scientifically trained departmental managers, and (2) expert operatives. The first class consists of resourceful well-trained chemists actually directing on the spot operatives of the second class. They must be men prepared to give directions when a reaction takes a different course from that expected; men with some engineering as well as chemical training; men who can carefully harvest from daily observations all those deductions which, in sum total, become invaluable knowledge. Such

accumulative experience of practical detail is the secret of success, leading yields higher and higher, making the labour cost of the product less and less, and resulting at times in important discoveries. This power of controlling complicated and delicate processes, not merely conscientiously but with intelligence and initiative, of observing closely and of appreciating what in the mass of observed details is of practical as well as of scientific importance, demands qualities of mind and of interest which are different from, though not incompatible with, those of the research chemist in the narrower sense. The industrial chemist may have the research instinct and will not need to starve it, but his hunger after new knowledge for its own sake must not prevent his giving interest and enthusiasm to saving on the cost of materials, labour, and fuel; and such work demands not merely a type of ability as specialised as that of the research chemist, but above all a type of training which our educational system appears most conspicuously to lack. I regard it as fundamental to the solution of the problem before us. For it is in synthetic chemical manufacture above all other branches of chemical manufacture that men of this kind are indispensable, and it is to lack of educational provision for their development and encouragement more than to anything else that I am disposed to attribute our failure in that field.

One needs to apologise, I suppose, for dealing at greater length with this well-worn topic of education, yet I feel compelled to do so by reason of the great need of some means for more quickly and effectively supplementing university education in these respects so as to fit men for the pursuit of industrial chemistry. As we have heard so often, the university graduate, including the B.Sc.Tech., has even less knowledge of how to contrive to apply his knowledge than the manufacturer has of how to utilise it; the result being that the chemist in his caged laboratory is held by his employer at arm's length from manufacturing operations, and his lack of self-confidence still further increases the difficulty of putting his knowledge into practice. The working foreman's rule-of-thumb knowledge—to which great respect is due—is commonly regarded by the manager as a bulwark not to be shaken by any theoretical considerations, however plausibly they may be put forward by the chemist; and experience often justifies this attitude because, although the chemist knows, he does not know that he knows, and he therefore lacks confidence in applying his knowledge. The first failure is regarded as proof of mistake instead of the first stepping-stone to success, which indeed it often is. The trained chemist, without understanding the practical application of knowledge, is in a dilemma in industry—he must either gain knowledge by risking mistakes or remain in insignificance in his laboratory. That is the difficulty; the question is, can we evolve a practical scheme for removing it? The orthodox educationalist view is, I believe, that after the stage of graduation, training can best be carried out either in the research laboratory or in the industrial establishment. My own view is that neither of these places at present affords the proper training required. The shortcomings of the research laboratory for this purpose have been already indicated, and it is self-evident that competitive industrial concerns will not facilitate the training of men either by affording them the necessary leisure or by enabling them to pass from one works to another. It is notorious that in fear of such men passing on secrets (some real, others imaginary) to competing firms, employers put many difficulties in the way of such training as the works might afford, and sometimes metaphorically keep their chemists locked up in the laboratory.

In addition to a sound and thorough fundamental knowledge of chemistry, physics, and engineering, and a little of many other things, the works chemist requires the knowledge of applying knowledge. He needs to understand the business of applying chemistry to manufacture, just as the engineer does the application of physics to the same end. At present we ignore the study of the history of industrial processes, the economics of chemistry, the accountancy of chemistry, and the applied mathematics, mechanics, and engineering of chemistry; yet all of these are subjects capable of being taught to great advantage and for the most part in the laboratory in much the same way as electrical and mechanical engineering are taught. The scheme which I desire to propose applies exclusively to students who have creditably passed through a full college curriculum. It involves the formation of one or more technological colleges of a new type. Such a college would itself be nothing less than a manufacturing concern, having a complete and well regulated course extending over, say, two years, the students of which would spend a considerable portion of their time in actually manufacturing, under the direction of experienced technical men, those inorganic and organic compounds which are required in relatively small quantities by educational and research institutions throughout the Empire. For supplies of these substances we have, to our no small discredit, been dependent almost entirely upon German enterprise, and even, in many instances, on that of one particular German firm. With such productions the ordinary manufacturer will not be troubled, since the demand is so small and irregular as to render them insufficiently remunerative.

The college would need a large permanent staff who would conduct it on lines of strict and complete business organisation and discipline. The hours of attendance would be not less than eight per day and the holidays short. To enforce the regulations, power of dismissal would be given to those in control, and no student would be able to proceed from one stage in his course to another without having qualified in the earlier one.

Structurally, the college would be composed of the lecture rooms, chemical, physical, and engineering laboratories, drawing office, and, in addition, a series of well-equipped manufacturing laboratories, with store-rooms, joiners' and fitters' shops, and so forth, and, lastly, but by no means of least importance, a power plant generating steam, gas, and electricity under such conditions that the efficiency is daily computed and under control. The steam, gas, water, and electricity supplied to each section should be recorded on meters, for the fundamental requirements must be that the student should learn to approach chemical operations quantitatively from the point of view of the value of raw materials, the yield of product, the heat and power absorbed, and time and labour expended.

To assist the student in getting the true commercial perspective he would, in the beginning, attend a course of instruction in accountancy and costing as exemplified in the system adopted throughout the college.

Having said so much of the general idea of my scheme I wish, before entering into other details, to explain that the object in view is not to teach the method of manufacture of a particular product or kind of product. Although this may be done successfully in the case of certain industries, as, for example, brewing and tanning, it is clearly impossible for the chemical industry in general; but the care and exercise of resource required in the manufacture of a selection of chemicals on the small manufacturing scale of from 5 to 1000 kilos. are typical of most manufactures, and instructions on these lines could, I claim, be made of immense

value, though, of course, the whole of a manufacturer's knowledge can, by no conceivable means, be given in an institution.

In his progress through the laboratories the student would spend some time during the first year in an analytical department, in which the intermediate and finished products are submitted to examination for purity. It would be the function of the permanent staff of this department to set such a standard of perfection in manufacture as should uphold the reputation of the college with the institutions using its products, and, incidentally in many cases, supplying it with students. Much of the care expended in the works would be determined by the efficiency of this department, and the fact that the reputation of the college would depend on the judgment of those institutions and colleges to which the products are supplied would act effectively in maintaining a standard of excellence of work.

During the first year the student would attend courses of instruction in physical and electro-chemistry, applied mathematics, construction and design, chemical engineering, machine drawing, etc.; he would also receive practical instruction in the repair shop and power-house, as well as in the use of special machinery and plant. He would take his turn at stoking, engine driving, making steam-joints, lead-burning, and so forth.

Passing into the works laboratory, first-year students would be set in small groups to manufacture at first simple inorganic compounds, and would be given an opportunity of watching the operations of advanced students. These manufacturing operations would need to be conducted under strict discipline as regards both time spent and quantitative results, and although from its nature the work would not be on the full scale of ordinary technical procedure, it would be carried out on a sufficiently large scale to require manufacturing apparatus as distinguished from that of the laboratory. During the first and second year, students gradually would become familiar with the construction and use of autoclaves, large reaction vessels, vacuum pans, gas compressors, furnaces, centrifuges, filter-presses, and so forth, and would acquire experience in handling difficult and dangerous substances, in utilising catalysts, etc. He would also have experience in designing special pieces of plant for particular technical processes. In the second year, courses of lectures would include various engineering aspects, among them steam raising and power production, every student spending several weeks in the department concerned with the supply of steam and power to the institution, and in a laboratory in which fuel, water, and flue gases, etc., are analysed.

Courses of instruction in special manufactures, such as sulphuric acid and alkali, would probably find their place in the curriculum; arrangements might be made for students destined for particular industries to attend special courses of instruction given by men actually engaged in the industries in question—proceeding which has already been adopted in the evening classes of some of our technical colleges.

Further, it would be an invaluable adjunct to such a college if arrangements could be made for students to attend courses of practical instruction in actual works. By careful arrangement this might be done with such slight interference to the business of the firms concerned during only a short period in each year that the opposition to the proposal would be satisfactorily met. Above all, it is essential that the staff of the college should consist mainly of men of ripened works experience—not, be it understood, men (however able) who have merely spent a period in the research or

analytical department of a works. Such men have usually been regarded by our educational authorities as men with works experience, when in point of fact they have little more real claim to a knowledge of chemical manufacture than has the average practising analyst.

As regards the nature of the substances manufactured, the first-year students would be occupied partly in making from raw material simple inorganic substances; for instance, potassium dichromate and permanganate, metallic arsenic and tellurium, hydrogen peroxide, hydriodic acid and ammonium persulphate, and partly in isolating and purifying far products, sugars, and natural vegetable products, such as theobromine and caffeine.

In the second and succeeding years—for it may be safely assumed that many students would remain longer than two years, and it should prove possible to pay them small salaries to do so—the students would be occupied in carrying out synthetic organic processes on the large scale; they would be enabled to follow each other's processes, being present to watch critical stages and so enlarging their experience.

The compounds manufactured would, in general, be those which, while not in common use, are required for exceptional purposes, chiefly by colleges and research laboratories. In order that the scale may be a large one it would be necessary to make of many substances much bigger quantities than are likely to be required; these might remain in storage for many years, and only gradually would a complete list of the substances in demand be accumulated.

One claim for this scheme is, that besides affording a really practical training, it would maintain and impart by means of actual manufacture and sales a standard of industrial efficiency almost impossible of attainment without this incentive. It would also have the further practical value of supplying many chemicals for which we have hitherto been dependent upon Germany. Nor need we fear that such a scheme would give serious offence in commercial quarters, for the monetary value of business in the manufacture of fine chemicals of this type is of no great account, and it would not be difficult to avoid jealousies by confining the manufacture to those substances which manufacturers of fine chemicals do not wish to produce.

If a manufacturer should complain that he is subjected to unfair competition through the production of a certain chemical by an endowed and privileged institution the reply is simple: let him produce a supply of the substance of adequate purity, and it may be assumed that the college of my conception would leave it to him.

Incidentally, the college would prove of great advantage to research workers, who would have here facilities for procuring the compounds with which their investigation commences, instead of spending a lot of their valuable time in repeating tedious preparations on a small scale. This single benefit, increasing as it would the effectiveness of research workers, would react favourably on the industry as a whole.

It may be objected that by the time a student has graduated he has no means to continue his education for two more years, making the course, say, five years in all. If we consider the number of medical students who find the means for a course of usually greater length the difficulty does not appear insuperable. It may be met to some extent by the suggestion that no student in this college should proceed to his second year unless

he merits promotion by his attendance and progress in the first year; it might then be possible to remit the fees in the second year, or even to give a small remuneration. The sales of the chemist's products would, perhaps, assist partly in enabling this to be done, but endowment by the Government as well as by the Association of British Chemical Manufacturers should do so more materially.

Chemical manufacturers commonly pay salaries to members of their staff who are trying to teach themselves what might be more quickly taught in the institution I have sketched, but still more must be spent for this purpose if our industry is to progress, and it would be far more economical to do so in the manner here proposed. No doubt can exist that contributions from employers through the Association of Chemical Manufacturers might afford a substantial and adequate endowment, but for the cost of the buildings and equipment surely we might justly look to the Government, for it is recognised in the highest quarters that our educational organisation must be directed to practical ends of this very nature.

Dealing next with the training of the expert operative, we recognise that his chief training ground is now the factory, and must remain so for the present. Unfortunately, the lack of an established apprenticeship system in the chemical trade renders this training very uncertain and at times valueless, and efforts are needed to improve it. Much may be done by utilising the research and analytical laboratories of works for the purpose of training selected boys from primary and secondary schools. To secure the success of such a method attendance at evening classes should be a condition of engagement in these laboratories, and the fees ought to be paid by the employer. This plan has many limitations, for not only may it be disadvantageous to the work of the laboratories to pass youths forward in this way, but the amount of attention which can be given to them is insufficient, and the number so trained does not meet the requirements of a growing industry. Our secondary schools, excellent though many of them are, fail lamentably to produce youths suitable for industrial careers. Too little latitude is granted by the Board of Education to permit of youths in a particular district being trained for industries belonging thereto, nor is there sufficient differentiation at the age of about thirteen in the training given to boys of quite different aptitudes. It would not be difficult in large towns to arrange that one or other institution should frame its course somewhat on the line of the old Mechanics' Institute, whose discontinuance has proved such a real loss—selecting the boys who are to attend it from all the other secondary schools of the district. The selection would be comparable to that which at present is made in the case of students proceeding to the commercial course in some secondary schools. Physics, mechanics, chemistry, mathematics, machine construction, and mechanical drawing should figure on the time-table, and the full course would extend to four years.

In addition to this modification of our secondary schools one cannot plead too often or too much for the Government of this country immediately to adopt compulsory continuation of the education of those brought up in our primary schools; at least eight hours per week should be so spent until eighteen years of age, the hours which people of this age can be employed in factories being limited to forty per week, and the secondary schools, already referred to, supplying the necessary classes.

But this is not the proper occasion for discussing in detail the large question of general primary and secondary education. It suffices here to call attention to the fact that chemical manufacture among many other industries would be greatly benefited by the reforms referred to.

No mention has been made of the educational provision for training research workers, because it is felt that our universities are capable of turning out all that we require. Of their capacity in this respect as well as of the competency of British students we may rest well assured. Of greater moment is it that manufacturers should understand the commercial value of pure research, and that they should, both by co-operating with the universities and by providing their own laboratories, render it possible for these researchers to carry on their investigations.

To look upon research as a business proposition has been distasteful to many of that great band of devotees to science who have been attracted thereto by the love of research and the quest of knowledge for its own sake, but I am sure it would be healthful if this attitude on the part of scientific men were somewhat modified so that matters of practical importance might, without prejudice to scientific reputation, frequently form the subject of research in academic laboratories and of theses for degrees.

The commercial exploitation of the results of researches is a matter calling for careful attention in this country in the domain of medicinal chemistry. This matter presents considerable difficulty, partly because the medical fraternity are very conservative and unwilling to adopt new remedies, but mainly because of the difficulty in getting drugs tested and getting official recognition of their utility. In Germany the demand for such new remedies has been created by medical men rewarded for their services, a system happily impossible in this country and one which may do damage to the health of the unfortunate consumers. To overcome these difficulties it is suggested that institutions, universities, and hospitals should co-operate in performing physiological and chemical tests of likely substances, and that some body such, for instance, as the Medical Research Committee should, on examination and confirmation of the evidence thus afforded, authoritatively express opinion on the usefulness of new drugs, which opinion, properly vouched for in this way, would no doubt be accepted by the medical practitioners. This is particularly difficult under the present system by which good and bad remedies alike become known to them by the advertisements of interested firms.

In conclusion, let me reiterate in a very few words what I have endeavoured to express at greater length in this paper, namely, that the future of synthetic chemical manufacture as well as of other branches of the industry in this country can only be secured by greater progress in organisation and by co-operation among the various firms engaged in it. That, in addition, there must be an important development in our system of technical education so as to increase the efficiency of labour and its scientific management. For this purpose I have put forward with all modesty certain practical suggestions.

Finally, let us not wander like the Lost Tribes of Israel in the Desert, crying aloud to the Government to act as our Providence, but let us continue to work out our own salvation, and trust the Government to give the assistance we need when we ask for it.

## Journal and Patent Literature.

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### I.—GENERAL; PLANT; MACHINERY.

*Heat transmission through boiler tubes.* H. Kreislinger and J. F. Barkley. Tech. Paper 114, U.S. Bureau of Mines. 36 pages.

The following deductions are drawn from a large number of measurements of the temperature of the inside and outside of the tubes of a boiler. The temperature of the boiler tube is very little affected by the temperature of the hot gases, and does not differ from that of the boiler water by more than 10°—20° C. The boiler tubes can easily transmit to the water all the heat which they receive from the hot gases, and providing the boiler and tubes are free from scale, oil, or deposit, it is impossible to overheat the tubes, however fast the boiler is worked. The passage of the heat from the hot gases to the tube takes up the most time, and an increase in the rate of working a boiler can only be effected by devices which increase the rate of transmission of heat from the hot gases to the boiler tubes. In steam pipes conveying saturated steam, the temperature of the outside of the pipe is practically identical with that of the steam.

—W. H. C.

*Saturated vapours [steam]; Relation between the temperature and pressure of \_\_\_\_\_. Kubierschky.* Z. angew. Chem., 1916, 29, 305—307.

THE relationship between the temperature and the pressure of saturated steam is very closely expressed by the equation  $\log p = \frac{5.1(t-100)}{t+230}$ , where  $p$  is the pressure in atmospheres. Expressing the pressure in kilos. per square cm., the equation becomes  $\log p = \frac{5.1(t-99.1)}{t+230}$ , and in mm. of mercury,  $\log p = \frac{5.1(t-100)}{t+230} + 2.881$ , or  $\log p = \frac{8(t+19)}{t+230}$

For temperatures between 35° and 300° C. the calculated pressures in no case differ from the observed pressures by more than 1%, and in most cases by very much less, and the above equations are therefore to be preferred to those of van't Hoff or van der Waals.—G. F. M.

#### PATENTS.

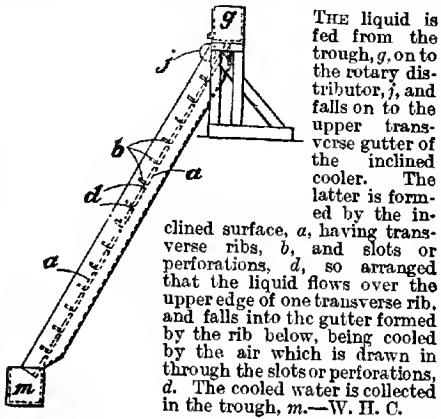
*Solids from liquids; Apparatus for the separation of \_\_\_\_\_. W. Russell, London. Eng. Pat. 11,666, Aug. 12, 1915.*

THE pulp is fed as a thin film on to a slightly inclined table so that the solid particles remain on the table (to be removed by a scraper) and the liquid drains off. Several circular tables having an inclination of less than 1 in 100 may be mounted one above the other on a central rotating shaft.—W. H. C.

*Water from air or steam and the like; Means for separating \_\_\_\_\_. J. E. Mortimer, London. Eng. Pat. 13,599, Sept. 24, 1915.*

ANNULAR ribs having lips on the side facing the current are disposed transversely in the conduit through which the air or steam flows, to arrest the particles of water thrown to the side by a helical baffle in the conduit, and convey them out of the path of the air or steam.—W. H. C.

*Cooling liquids; Apparatus for \_\_\_\_\_. S. Bates, Prudhoe-on-Tyne. Eng. Pat. 15,931, Nov. 11, 1915.*



THE liquid is fed from the trough,  $g$ , on to the rotary distributor,  $j$ , and falls on to the upper transverse gutter of the inclined cooler. The latter is formed by the inclined surface,  $a$ , having transverse ribs,  $b$ , and slots or perforations,  $d$ , so arranged that the liquid flows over the upper edge of one transverse rib, and falls into the gutter formed by the rib below, being cooled by the air which is drawn in through the slots or perforations,  $d$ . The cooled water is collected in the trough,  $m$ .—W. H. C.

*Filtering media of filtering apparatus; Means for cleansing the \_\_\_\_—wherein air is introduced with the cleansing liquid.* J. Wilson, London. Eng. Pat. 16,901, Dec. 1, 1915.

PERFORATED hoods of inverted V-shape are fitted over the inlet pipes for the cleansing liquid to form separating chambers, the washing liquid escaping through the lower and the air through the upper perforations, and thence passing upwards through the filtering medium.—W. H. C.

*Filter. Filtration of liquids. Filter.* E. G. Acheson, Assignor to Acheson Corporation, New York. U.S. Pats. (a) 1,193,333, (b) 1,193,334, and (c) 1,193,335, Aug. 1, 1916. Dates of appl., (a) and (b) Mar. 3, 1916, (c) June 5, 1916.

(a). A FILTER element of porous ceramic material is made of arched form continuous with a surrounding thicker annular portion. The arched portion is completely contained between the upper and lower planes of the annular portion and forms a partition within an enclosing casing. (b). A filtering medium for liquids is formed by stirring or kneading clay with a deflocculating agent and then moulding and baking it. (c). A filtering element is formed of a surface layer of the material described in (b) with a backing of relatively permeable material.

—W. F. F.

*Filtering-frame for filter-presses.* W. Guerrero, Madrid. U.S. Pat. 1,193,779, Aug. 8, 1916. Date of appl., Mar. 17, 1915.

A RECTANGULAR frame is provided with sockets along two opposite inner edges. A double grate within the frame consists of parallel members with transverse connecting portions; the latter alone engage with the sockets, and the other members are substantially flush with the opposite faces of the frame.—W. F. F.

*Grinding mill; Comminuting body for* —. R. C. Newhouse, Milwaukee, Wis., U.S.A. Eng. Pat. 101,055, Mar. 3, 1916. (Appl. No. 3214 of 1916.

THE grinding bodies have the form shown in the figure, the generating radii of all the curved surfaces being approximately equal.

—W. H. C.



*Kiln*. J. N. Silva, Pueblo, Colo. U.S. Pat. 1,192,946, Aug. 1, 1916. Date of appl., Aug. 28, 1915.

A NUMBER of kilns are arranged in a group connected with air feeding and waste gas exhaust tunnels, which surround each kiln and are connected at one end with the air feed and at the other with the exhaust tunnel. Connection with either or both of the tunnels can be established or cut off by suitable valves.—W. H. C.

*Dry-kiln*. J. F. Oldfield, Bel Air, Md. U.S. Pat. 1,193,596, Aug. 8, 1916. Date of appl., Oct. 16, 1912.

A KILN of rectangular section with sloping roof is provided with double side walls and the space between them is divided by vertical partitions into flues, each having an opening in the roof. The flues also communicate with the drying chamber by openings of which the height increases from one end of the kiln to the other, and heating means are provided between the floor and a track which is situated above the flue openings.—W. F. F.

*Drying apparatus*. F. W. Adolf, New Brighton, Pa. U.S. Pat. 1,194,118, Aug. 8, 1916. Date of appl., Mar. 1, 1916.

THE apparatus consists of three vertical concentric tubes between the inner and intermediate of which two parallel helical flanges are provided. The inner tube opens at the bottom into a furnace, the hot gases from which pass up the tube and then down through one of the helical passages and also the outer annular space. The material to be dried passes downwards through the other helical passage.—W. F. F.

*Vacuum-evaporator; Continuously operating* —. J. do A. Castro, Sao Paulo, Brazil. U.S. Pat. 1,193,359, Aug. 1, 1916. Date of appl., Dec. 17, 1915.

THE liquid is caused to flow down a series of superposed inclined trays arranged within a chamber connected with a vacuum pump, and the heating medium is caused to pass below each tray in an upward direction from tray to tray. Scrapers are provided to remove the material from the upper surface of the trays and the dried product is removed from the bottom of the chamber by a hollow conveyor which also acts as a cooler.

—W. H. C.

*Centrifugal extractor*. A. E. W. Jahn, New York, Assignor to Troy Laundry Machinery Co., Ltd. U.S. Pat. 1,193,697, Aug. 8, 1916. Date of appl., Aug. 4, 1914.

A BASKET mounted on a vertical rotating shaft is surrounded by a casing and provided with a ball-bearing between its upper rim and the wall of the casing which permits a limited vibration of the basket.—W. F. F.

*Boiler*. W. L. R. Enmet, Schenectady, N.Y., Assignor to General Electric Co. U.S. Pat. 1,194,157, Aug. 8, 1916. Date of appl., Dec. 12, 1912. Renewed Dec. 3, 1915.

A NUMBER of vertical heating tubes open at their

upper ends into the base of a common vapour chamber and are closed at their lower ends. Each tube is provided with a central core of non-conducting material with a small axial opening which communicates at the top with the vapour chamber and at the bottom with the narrow annular space between the tube and core; the upper end of the axial opening is enlarged to form a cup to which the liquid to be vaporised is fed by gravity. The core may be enclosed by a metal envelope.—W. F. F.

## IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

*Gases from [coal] mine fires; Explosibility of* —. G. A. Burrell and G. G. Oberfell. U.S. Bureau of Mines, 1915. Tech. Paper 134. (29 pages.)

FROM the results of analyses of samples of the gases from fire-areas in various mines, and a comparison of mine-fire combustion processes with those in gas producers, gas retorts, and boiler furnaces, it is concluded that, in addition to the methane naturally emitted by coal in "gaseous" mines, the carbon monoxide, methane, and hydrogen produced by the action of heat on coal are largely responsible for explosions which occur when ventilation is stopped during a mine fire. Methane is the most dangerous as regards low limit of explosibility; while carbon monoxide and hydrogen are especially dangerous because of their wide explosive ranges. The proportions of hydrogen, carbon monoxide, and paraffin hydrocarbons (mainly methane) produced by the destructive distillation of coal between 339° and 1100° C. may vary between 0 and 73, 2 and 16, and 2-5 and 71%, respectively. At low temperatures the proportions of hydrogen and carbon monoxide formed are lower than that of methane, the latter thus forming the principal source of danger in low-temperature mine fires. In the case of a mine fire which has been burning for some time, it is probable that when the oxygen of the air has been so depleted that products of distillation appear, the embers will have cooled to a point where the low-temperature products are given off in largest quantity. Carbon monoxide formed by the action of hot carbon on carbon dioxide is a highly important agent in some mine-fire explosions; but water-gas produced by the action of steam on hot carbon probably plays a relatively unimportant role.—W. E. F. P.

*Water in coal; Some properties of* —. H. C. Porter and O. C. Ralston. U.S. Bureau of Mines. Technical Paper 113. 30 pages.

THERE is no ready means of separating the free water ("moisture") and inherent or "combined" water in coal, as some of the latter is removed even when the coal is dried over sulphuric acid or phosphorus pentoxide. Calcium chloride is unsuitable as a desiccant for coal as the aqueous tension of the dihydrate is too high. Different kinds of coal in an air-dried condition contain widely different proportions of water and, conversely, equal percentages of water in various coals produce very different vapour pressures. This is due to the inherent water in coal having a sub-normal vapour pressure and indicates the presence of variable proportions of colloidal matter in coal. When coal is wetted, a rise in temperature occurs which depends on the nature of the dry coal and on the proportion of water in it, the increase in temperature being highest with perfectly dry coals. The fineness of the samples does not affect the results. Determinations of the specific heat of dried and undried coals showed that the inherent water in coal has a molecular heat lower than the

normal. The authors conclude:—(a) That it is impossible to dry coal thoroughly in an atmosphere which is not absolutely dry; (b) that the extremely hygroscopic character of dry coal may lead to serious errors if it is overlooked; (c) that large changes occur in the humidity of coal exposed to the atmosphere; (d) that the free water adhering to broken coal varies according to the size of the particles and to the nature of the coal; and (e) that the rate at which coals can be dried depends on the origin of the sample, the mature Appalachian coals drying more rapidly than the more hygroscopic younger coals of the Middle West and West of the United States.—A. B. S.

*Coals; Graphic studies of ultimate analyses of —.*  
O. C. Ralston. Tech. Paper 93, U.S. Bureau of Mines. 41 pages.

By a modification of the ordinary system of trilinear co-ordinates the author has plotted the results of a large number of coal analyses calculated on a basis of pure coal, that is, the carbon, hydrogen and oxygen made equal to 100%. The resulting diagram shows that the various grades of coal of the generally accepted classification fall into definite fields on the diagram. By connecting the points of coals of equal calorific value and also those having equal volatile matter, a series of curves, called "isocals" and "isovols" is obtained which show that there is an undoubted relation between the ultimate analysis and each of the above qualities, and a combination diagram of isocals and isovols crossing each other, shows the possibility of predicting the ultimate analysis from the calorific value and volatile matter and vice versa. No relationship could be established between the moisture, ash, sulphur, and nitrogen and the properties of the coal.—W. H. C.

*Coke-ovens; Recovery of by-products from — in the United States.*

ACCORDING to a report issued by the U.S. Geological Survey the value of the by-products recovered from coke-ovens in 1915 was nearly \$30,000,000, as compared with \$17,500,000 in 1914. The greatest increase was in benzol products, the value of which increased from less than \$1,000,000 in 1914 to more than \$7,700,000 in 1915. The quantity of coal carbonised in by-product recovery coke-ovens in 1915 was 19,500,000 short tons. The amounts and value of the products are shown in the following table:—

Products.	Quantity.	Value.
Tar obtained and sold, gallons	138,414,601	\$3,568,384
Ammonia obtained and sold:		
Sulphate, lb.	19,900,487	5,648,958
Liquor, gallons	10,626,612	1,210,473
Anhydrous, lb.	30,002,194	2,978,044
Gas produced, million cb. ft.	213,667,614	—
Surplus gas sold or used:		
Illuminating, million cb. ft.	17,196,426	3,083,311
Domestic fuel, million cb. ft.	27,590,624	3,158,129
Industrial fuel, million cb. ft.	39,568,864	2,383,459
Benzol products:		
Crude light oil, gallons	13,082,678	4,304,281
Secondary light oil, gallons	182,039	28,731
Benzol, gallons	2,516,483	1,423,323
Toluol, gallons	623,506	1,529,803
Solvent naphtha, gallons	196,151	46,233
Naphthalene, lb.	465,865	40,959
Other products*	—	379,491
Coke, short tons	14,072,895	48,555,325
		78,382,904

\* Includes breeze, retort carbon, domestic coke, and coke dust, and aniline oil.

The increase in by-product coking has been very great since the beginning of 1916, and production is far in excess of the 1915 figures.

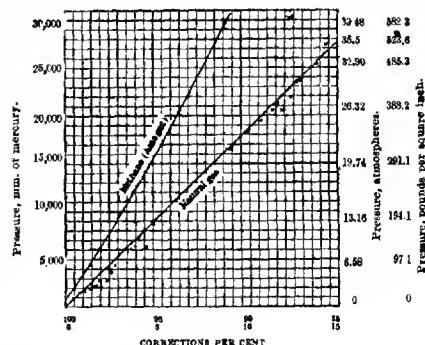
*Carburetted water-gas manufacture; Decomposition of hydrocarbons and the influence of hydrogen in —.*

M. C. Whitaker and E. H. Leslie. J. Ind. Eng. Chem., 1916, 8, 593—601, 684—695.

The decomposition of a vaporised paraffin hydrocarbon oil (sp.gr. 0.8, b.pt. 150°—265° C.) at atmospheric pressure and at temperatures of 621°, 723°, and 825° C. respectively, was studied, using the electrically-heated furnace described previously (Whitaker and Alexander, this J., 1915, 705), and the effect of varying the oil feed and of adding hydrogen at different concentrations (approximating 1H<sub>2</sub>; 2 oil gas and 2H<sub>2</sub>; 1 oil gas respectively) was investigated. The experimental results are given chiefly in the form of curves. When oil is cracked in an atmosphere of hydrogen, the absorption of hydrogen is greater the higher the temperature, and the lower the rate of oil feed. There is no marked difference in the amount of tar formed in presence or in absence of added hydrogen below 723° C. At 825° C. less tar is formed when hydrogen is added. The proportion of tar increases with decrease of temperature and with increasing rate of oil feed, particularly at the lower temperatures. Below 723° C. the tar formed consists largely of unchanged or partially changed oil. The proportion of the carbon of the oil which appears as hydrocarbons in the gas is largely increased by addition of hydrogen. The volume of illuminants produced per unit volume of oil increases, in general, with the temperature. About one-third by volume of the illuminants in the gas consists of propylene and higher olefines. The formation of ethane is not large at any temperature, but the formation of methane is greater the higher the temperature. A decomposition temperature of about 825° C. appears most desirable provided too great opportunity for extensive secondary and tertiary changes is not given. It is suggested that in commercial practice the best results would probably be obtained by cracking the oil in an apparatus designed and operated primarily for the production of gas, and then carburetted the gas in a second apparatus with the tar formed in the first.—A. S.

*Natural gas at high pressures; Compressibility of —.* G. A. Burrell and I. W. Robertson. U.S. Bureau of Mines, 1916. Techn. Paper 131. Petroleum Technology 31. [6 pages.]

In comparing the compressibility of natural gas (Pittsburgh) with that of an ideal gas (methane) at different pressures, the results shown in the



accompanying chart were obtained. The practical value of the results is apparent since, in commerce, natural gas is frequently measured at pressures up to 40 atmospheres.—W. E. F. P.

*Sabatier's catalytic actions.* [Hydrogenation of ethylene.] U. Grassi. *Nuovo Cim.*, 1918, [vi], 11, i, 147—163. J. Chem. Soc., 1918, 110, ii, 425.

THE author has investigated the hydrogenation of ethylene in presence of recently reduced copper at various temperatures between 150° and 300° C. The catalyst at first exhibits variable activity, but gives constant and reproducible results after it has been subjected for several hours to the action of a circulating mixture of ethylene and hydrogen at 250° C. The thermostat and thermoregulator were charged with dense automobile oil, which exhibits sufficient mobility at temperatures above 50° C. to admit of uniform distribution of the temperature. The mean values of the initial velocities of the hydrogenation at different temperatures are as follows: 150° C., 0.25; 200°, 1.10; 250°, 1.19; and 275° C., 1.21. The velocities of the reaction are found to be rigorously proportional to the concentrations of the hydrogen and ethylene, and the conclusion is drawn that the reaction is of the type of absorption reactions. The anomalous values of the temperature coefficient of the reaction, which should be about 2, but is low at 150°—200° C., and lower still at higher temperatures, are explainable according to Trautz's theory of the influence of temperature on the velocity of reaction (J. Chem. Soc., 1910, 98, ii, 24; 1912, 102, ii, 746). This theory leads to the result that the temperature at which the maximal velocity of a reaction is reached becomes lower as the heat of formation from the elements of the system diminishes; in the present case the heats of formation of ethane and ethylene are +23,300 and —14,800 cals. respectively, and the maximal velocity is attained or approached at 275° C.

*Kerosene shale as a gas and power producer.* E. V. Espenahn. Soc. Chem. Ind. of Victoria, June, 1916. J. Gas Lighting, 1916, 125, 398—400.

TESTS under working conditions have shown that the kerosene shale (torbanite) of New South Wales yields a large quantity of gas of high illuminating value, the author quoting instances of 15,399 and 17,160 cb. ft. per ton, of an illuminating power of 46.35 and 43.02 candles respectively. The coke has a high percentage of ash and is useless for ordinary firing purposes. A high yield of tar is obtained but it is not in a form to permit its economical use as a heating or power agent without further treatment. The author gives results of experiments carried out by himself and Seeger in Bunte's laboratory with a view of ascertaining conditions for the production of a gas of a gross calorific value of 520 to 560 B.Th.U. per cb. ft. By simple distillation at 700° and 1000° C., only low yields of gas were obtained. Cracking the volatile products at 800° C. resulted in a large increase of permanent gases and in the conversion of hydrocarbons condensed as tar into aromatic compounds, with formation of some free carbon. At higher temperatures the volatile products suffered further decomposition and at 1000° C. the gas increased by 50% but at the cost of the calorific value, which decreased by 40%. Still higher yields of gas were obtained and the production of tar reduced to a minimum by cracking the volatile products in presence of steam, but it was difficult to regulate the steam under laboratory conditions so as to ensure uniform results. In two tests in which cracking was effected at 1000° C., the yields of gas were 40,800 cb. ft. of gross calorific value 582 B.Th.U. per cb. ft. and 45,800 cb. ft. of 532 B.Th.U. per cb. ft. at 60° F. and 30 ins., the yields of tar being 2.9 and 1.2% respectively. It would not be difficult to regulate the steam on a works scale and the prospects of adapting the process for the manufacture of illuminating gas appear favourable,

the author giving a description of his method for carbonisation of such shale. The crushed shale passes through vertical retorts and the residue is withdrawn at intervals into bunkers from which it is fed into a producer of revolving grate type with air-blast. The producer gas after meeting preheated secondary air passes through heating flues (forming the superheater) which are maintained at any desired temperature. Part of the producer gases pass to the heating flues of the vertical retorts, heating the lower section up to 700° to 820° C. The sensible heat of the remainder is taken up in the regenerator for preheating the secondary air. Steam is admitted into the retorts below the hottest zone, whilst the permanent gases on leaving the retorts are separated from the oils, condensed at lower temperature, and treated for recovery of ammonium sulphate. The oil is fed along with steam into the superheater where fixation into permanent gases takes place. The permanent gases formed in the first instance are passed with oil into the superheater or may be used for carburettting the mixed oil and water-gas. All grades of mineral are not suitable for this process as in the case of a first-class shale the fixed carbon would probably not suffice to maintain a combustion zone. Scotch shales contain a high percentage of ash and probably would be unsuitable for gaseous firing, without considering the economic value of the mineral as an oil producer.—J. E. C.

*Petroleum production of the world in 1915.* U.S. Geol. Survey.

THE total quantity of crude petroleum entering the world's markets in 1915 amounted to 426,892,673 barrels, or 7% more than the 1914 production. The bulk of the increase in 1915 came from the United States and Mexico, though Russia, Argentina, and Japan recorded significant gains. The distribution of this production is shown in the following table:—

Country.	Quantity, 1915.	
	Brls. of 42 g's.	Metric tons.
United States	*281,104,104	87,480,547
Russia	68,548,082	9,353,077
Mexico	32,910,508	4,388,663
†Dutch East Indies	12,380,808	1,710,445
Roumania	12,029,913	1,673,145
India	17,400,000	980,607
Galicia	4,158,899	574,388
Japan and Formosa	3,118,464	415,785
Peru	2,487,251	331,633
Germany	995,784	114,000
Trinidad	†750,000	100,000
Argentina	516,120	75,000
Egypt	221,758	29,569
Canada	215,464	28,729
Italy	89,548	11,500
Other	†10,000	1,333
Totals	426,892,673	57,298,756

\*Marketed production. †Includes British Borneo. ‡Estimated.

*Petroleum; Emulsified or cut.* C. K. Francis. J. Ind. Eng. Chem., 1918, 8, 682—684.

A SAMPLE of emulsified petroleum from the Cushing field, Oklahoma, yielded 1.6% of sediment when treated for 10 min. in a centrifuge at 1450 revs. per min.; the sediment contained only a very small proportion of solid matter. When a portion of the oil was filtered, and the residue washed with gasoline, the final residue amounted to 0.51% and comprised 0.28% of non-volatile mineral matter and 0.23% of organic and volatile substances. The mineral matter consisted of sand, 2.0%; gypsum, 13.3%; calcium chloride, 7.0%; magnesium chloride, 0.91%; and sodium chloride,

75.45% ; the quantity of salts was more than sufficient to saturate the water present in the oil. The presence of the chlorides explains the corrosive action of such emulsified oils on the stills, etc., in the refinery ; this action is so severe that some pipe lines refuse to accept emulsified oils. The treatment adopted in Oklahoma consists in introducing the oil below the surface of water warmed to 80°—125° F. (27°—52° C.) in a tank. The slight expansion causes the breaking of the oil film, and the aqueous liquid subsequently soon separates from the oil in the stock tank.—A. S.

*Petroleum : Distillation [cracking] of —.* Selsky. J. Russ. Phys.-Chim. Obschtestwa, 1915, 9. Chem.-Zeit., 1916, 40, Rep., 285.

THE carbonaceous deposit which is formed in considerable quantities when petroleum is cracked in iron retorts contains about 70% of carbon and 30% of iron. When decomposed with hydrochloric acid it yields a mixture of combustible gases containing 85% of hydrogen, 12% of methane, and 2.2% of olefines. The best yields of benzene and toluene are obtained when petroleum is cracked in tubes filled with alumina and titanium oxide, which act as catalysts.—A. S.

*Propane-butane fraction from natural gas condensate ; Thermal decomposition of the —.* J. E. Zanetti. J. Ind. Eng. Chem., 1916, 8, 674—678.

THE propane-butane fraction which condenses along with the pentanes in the recovery of gasoline from "wet" natural gas, and forms what is called the "wild gasoline," is usually allowed to escape during the "ripening" process, but is sometimes condensed in steel cylinders and sold as "liquid gas," "gasol," etc. In some places after the first gasoline fraction has been separated, the gas is compressed further, and the propane-butane fraction condensed together with ethane for use as an illuminant and for welding with oxygen. The author's experiments were made with a product sold as "liquid gas" in steel cylinders under 100 lb. pressure ; it consisted of propane with about 3% of butane. The gas was passed at atmospheric pressure and at a rate of 0.45 cb. ft. per hour through a quartz tube, 30 in. long,  $\frac{1}{4}$  in. diam., heated in an electric furnace ; tar-fog was separated from the reaction products by an electrical method. It was found that up to 750° C. no aromatic compounds (tar-fog) were formed, the decomposition products consisting of unsaturated hydrocarbons (ethylene, butylene, etc.) and hydrogen ; the percentage of hydrogen increased continuously with rising temperature, whilst the percentage of unsaturated hydrocarbons increased to a maximum (about 38.5%) at 750° C. and then decreased. The results were practically the same in the presence of copper gauze, but with nickel gauze or iron gauze, the formation of aromatic hydrocarbons was inhibited and decomposition into hydrogen and free carbon promoted. Benzene, toluene, and naphthalene were identified in the tar, of which about 10 c.c. was formed per cb. ft. of gas.—A. S.

*Thermolised paraffin base oil ; Viscosity of a —.* G. Egloff and R. J. Moore. Met. and Chem. Eng., 1916, 15, 192—193.

A PARAFFIN base oil was cracked at varying temperatures at constant and varying rates of flow with the following results :—

TABLE I.  
Viscosities of a paraffin base oil cracked at varying temperatures and constant rate of oil flow of 16 gallons. per hour.

Temperature, °C.	500°	550°	600°	650°	700°
Viscosity, Engler deg.....	1.104	1.151	1.245	1.394	1.055

TABLE II.

*Effect of rate of flow on the viscosity of a cracked paraffin base oil at constant temperature of 600° C.*

Rate, galls. per hour .....	12	16	22	30	36
Viscosity, Engler deg.....	1.330	1.245	0.906	1.151	1.161

—W. H. C.

*Boiling points and critical temperatures of homologous compounds [paraffins and isoparaffins].* S. Young. Scient. Proc. Roy. Dublin Soc., 1916, 15, 93—98.

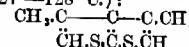
THE rise of boiling point in a homologous series, due to the introduction of a  $\text{CH}_3$  group, may be regarded as a function of the absolute temperature, and is closely expressed by the equation

$$\Delta = \frac{144.86}{T^{0.01485/T}}$$

where  $\Delta$  is the difference between the absolute boiling point  $T$  of a member of the series and its next higher homologue. Applied to the series of normal and isoparaffins this formula gives much more accurate results even for the lower members than the earlier equations of Ramage or Ferguson ; of the whole series from  $\text{CH}_4$  to  $\text{C}_{19}\text{H}_{40}$  for example only ethane shows a difference greater than 2° C. from the observed boiling point, whilst in 13 cases the difference is less than 1° C. As regards the relation between the absolute critical temperatures and boiling points, the ratio  $T_c/T_b$  diminishes in a homologous series with rise of molecular weight, and the ratio for iso-compounds is greater than for normal.—G. F. M.

*n-Octane ; Action of sulphur on — under pressure.* W. Friedmann. Ber., 1916, 49, 1344—1352.

ON heating with sulphur in a sealed tube at 280° C., *n*-octane (b.pt. 124.5°—125° C.) gives small yields of diethylthiophene (b.pt. 179°—180° C.) and dimethylthiophene (m.pt. 116°—117° C. ; m.pt. of picrate, 127°—128° C.) :



Carefully fractionated *n*-octane heated at 280° C. in a sealed tube gives a series of fractions boiling from 113° to 127° C., and it is considered that the formation of an iso-butane precedes and explains the production of the above sulphur compounds.

—F. W. A.

#### PATENTS.

*Washing coal and other minerals ; Method and apparatus for —.* P. Habets, Montegnée, and A. France. Liège, Belgium. Eng. Pat. 15,689, June 30, 1914. Under Int. Conv., July 26, 1913.

THE apparatus described in Eng. Pats. 22,655 of 1912 and 17,011 and 17,012 of 1913 (this J., 1914, 471) is provided with a flooded elevator or conveyor for removing the heavier materials without loss of water. The hydrostatic pressure in the receiver and the water currents between the receiver and the main trough are controlled by regulating flaps and adjustable vertical passages between the vessels.—W. H. C.

*Peat ; Preparation of — for fuel, or for destructive distillation and carbonisation.* E. A. Paterson, Thorold, Ontario. Eng. Pats. 12,003, Aug. 19, 1915, and 2530, Feb. 19, 1916.

SUPERFLUOUS water is removed, the material is disintegrated, neutralised if necessary by addition of an alkaline substance, mixed with alkali silicate solution, with or without the addition of solutions of boric acid and calcium chloride, moulded into bricks or the like, and dried.—J. E. C.

*Fuel made from anthracite coal refuse, and process of making same.* A. Schmidt, Philadelphia, Pa. U.S. Pat. 1,192,942, Aug. 1, 1916. Date of appl., Sept. 2, 1909.

ANTHRACITE coal-waste is mixed with a calcareous binder, which is rendered porous by incorporating with lampblack and its included air.—J. E. C.

*Coke; Apparatus for discharging and quenching* —. S. N. Wellington, London. Eng. Pat. 16,108, Nov. 15, 1915.

MECHANICAL rams take up the weight of the bottom doors of the retorts, and the doors are then disengaged and lowered, allowing the mass of coke to descend gradually into receptacles below. Water is sprayed on the outside of the receptacles and the coke is quenched without actual contact with the water. The apparatus runs on rails and is taken to the screening plant, the elevation of the ram delivering the coke on to the screens.—J. E. C.

*Coke ovens; Recuperative* —. A. Roberts, Evanston, Ill. U.S. Pat. 1,193,066, Aug. 1, 1916. Date of appl., Dec. 4, 1914. Renewed May 8, 1916.

RECUPEATORS are situated between the heating flues of two adjacent retorts and are constructed as independent elements capable of being removed without disturbance of the retorts and allowing independent expansion, adjustment, etc. (See following abstract.)—J. E. C.

*Recuperator wall.* A. Roberts, Evanston, Ill. U.S. Pat. 1,193,009, Aug. 1, 1916. Date of appl., Jan. 3, 1916.

A RECUPERATOR wall is built up of blocks laid in courses, each block being recessed to provide a meshwork of interconnected vertical and horizontal passages.—J. E. C.

*Coke oven; Regenerative* —. A. Roberts, Evanston, Ill. U.S. Pat. 1,193,067, Aug. 1, 1910. Date of appl., Feb. 23, 1915. Renewed May 8, 1910.

A PAIR of regenerators extends lengthwise beneath the central portion of the ovens. Between these and the oven is situated an air supply passage connected to the regenerators. Tunnels also running lengthwise are connected to the regenerators. The air passages and the tunnels are intermediary chambers between the regenerators and the heating flues.—J. E. C.

*Coke ovens; Expansion control for* —. A. Roberts, Evanston, Ill. U.S. Pat. 1,193,068, Aug. 1, 1916. Date of appl., Aug. 5, 1915.

THE heating walls are held in position by struts acting against their upper and lower extremities so as to allow independent expansion and contraction of the heating walls of individual ovens.—J. E. C.

*Furnace with vertical retorts and gas producers beneath the retorts.* Bunzlauer Werke Lengersdorff und Co., Bunzlau. Ger. Pat. 293,064, Jan. 5, 1915.

A RECUPERATOR is provided alongside each retort or group of retorts to furnish preheated air for burning the producer gas. The producer chamber is inclined, the charging opening being on the retort side, so that the hot coke can be discharged directly from the retort into the producer, whilst the outlet for ashes from the producer is on the recuperator side.—A. S.

*Gas; Manufacture of* —. Anglo-Mexican Petroleum Products Co., and R. P. Brousseau, London. Eng. Pat. 6873, May 7, 1915.

COAL is mixed with bitumen of a hard, brittle, and refractory nature obtained by the distillation of petroleum at high temperatures. From 5 to 7½% of bitumen may be used, and the mixture is treated in retorts as in gas manufacture.—J. E. C.

*Blast-furnace gases; Dry process and apparatus for purifying* —. Dortmunder Bruckenbau C. H. Jucho, and F. Häring, Dortmund, Germany. Eng. Pat. 17,081, Dec. 4, 1915.

THE gas is passed through a filter formed of several layers of iron borings or turnings compressed in a heated condition into a frame. The filter is rotatably mounted in the gas main, so that whilst one portion is in position in the main, another portion is without the gas main and can be cleaned.—W. H. C.

*Peat; Treatment [decatering] of wet-carbonised* —. T. Rigby, Dumfries, Scotland, Assignor to Wetcarbonizing, Ltd., London. U.S. Pat. 1,193,924, Aug. 8, 1916. Date of appl., July 11, 1914.

SEE Eng. Pat. 17,773 of 1913; this J., 1914, 1003.

*Fuel [; Smokeless* —]. H. Clarke, London, and J. A. Campbell, Ilford. U.S. Pat. 1,193,763, Aug. 8, 1916. Date of appl., Aug. 4, 1911. Renewed Jan. 24, 1916.

SEE Fr. Pat. 436,948 of 1911; this J., 1912, 481.

*Coke-oven; Regenerative* —. N. Schuster, London. U.S. Pat. 1,193,830, Aug. 8, 1916. Date of appl., Dec. 21, 1914.

SEE Eng. Pat. 29,517 of 1913; this J., 1914, 410.

*Gas retorts; Settings of* —. H. A. Carpenter, Sewickley, Pa., and Ritter-Conley Manufacturing Co., Leetsdale, Pa., U.S.A. Eng. Pat. 191,116, June 8, 1915. (Appl. No. 4128 of 1916.)

SEE U.S. Pats. 1,150,807 and 1,150,808 of 1915; this J., 1915, 948.

*Gas producer.* S. Glover, St. Helens, and J. West, Southport. U.S. Pat. 1,194,730, Aug. 15, 1916. Date of appl., Nov. 9, 1915.

SEE Eng. Pat. 5315 of 1915; this J., 1916, 297.

*Petroleum hydrocarbons; Method for converting higher-boiling* — *into lower-boiling hydrocarbons.* G. W. Gray, Houston, Tex. U.S. Pats. 1,193,540 and 1,193,541, Aug. 8, 1910. Date of appl., Jan. 23, 1913.

SEE Eng. Pats. 17,838 and 17,839 of 1913; this J., 1914, 1044.

*Petroleum and shale oils; Process of treating* —. H. W. Knottenbelt, Brussels. U.S. Pat. 1,194,033, Aug. 8, 1916. Date of appl., Jan. 13, 1910.

SEE Fr. Pat. 411,780 of 1910; this J., 1910, 933.

*Hydrocarbons; Process of cracking* —. W. A. Hall, New York. U.S. Pat. 1,194,289, Aug. 8, 1916. Date of appl., Mar. 21, 1916.

SEE Eng. Pat. 1594 of 1915; this J., 1916, 626.

## II.B.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

*Wood oils suitable for ore flotation.* Palmer and others. See X.

### PATENTS.

*Wood alcohol and calcium acetate; Method and apparatus for obtaining* — *from acetate liquor.* C. L. Campbell, Assignor to E. B. Badger and Sons Co., Boston, Mass. U.S. Pat. 1,192,987, Aug. 1, 1916. Date of appl., Jan. 3, 1912.

THE liquor derived from the distillation of wood is freed from tar, neutralised with lime, and passed continuously through a still. Alcohol is removed

from one part of the apparatus, and the liquor removed from another part is decanted from impurities, heated, and concentrated. The steam produced in the latter operation is returned to the still to supply heat for distillation.—W. F. F.

*Heating; Method of* —. H. L. Doherty, New York. U.S. Pat. 1,194,151, Aug. 8, 1916. Date of appl., Jan. 9, 1912.

A MIXTURE of combustible gases and combustion products is passed at high temperature through a bed of fuel, whereby the combustion products and fuel interact to produce additional combustible gas. The mixture is passed in a stream through a heating chamber and air is added in successive portions. Partly burnt and completely burnt gases are withdrawn at different points, mixed, and passed through a fuel bed and then into the heating chamber. The residue of completely burnt gases not previously withdrawn is passed through a recuperator to heat the air for combustion.—W. F. F.

*Electric lamps; Manufacture of incandescence* —. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 11,544, Aug. 10, 1915.

"GETTERS" such as the halogen compounds specified in Eng. Pat. 15,621 of 1910, are applied directly to the heated metallic filament by painting or spraying them while suspended or dissolved in a non-aqueous liquid. The coating may be protected during subsequent manipulation by the addition of another coating of a solution of nitrocellulose in amyl acetate with or without wood alcohol and ether. The "getter" may consist of sodium chloride, or a single coating may be employed consisting of finely powdered double fluoride of sodium and iron made into a paste with a non-aqueous liquid and mixed with a solution of nitrocellulose.—W. F. F.

*Preparation of peat for fuel, or for destructive distillation and carbonisation* —. Eng. Pats. 12,003 of 1915 and 2530 of 1916. See II A.

### III.—TAR AND TAR PRODUCTS.

*Synthetic phenol plant; Mechanical engineering of a* —. F. Pope. Met. and Chem. Eng., 1916, 15, 185—192.

THE benzol is stored in an iron tank contained in a building which can be heated in winter, and is pumped into the measuring tanks. The acid is also stored in tanks in a similar building. The charges of benzol and sulphuric acid are weighed in tanks and run into the sulphonating kettles which are of cast iron and provided with agitators of the propeller type, steam jackets, and thermometers, and connected with reflux coils of ample capacity. The sulphonated benzol is run into the liming tubs, which are of yellow pine or iron, provided with stirrers and leaden cooling coils. The lime mixing tanks are situated above the liming tubs and have agitators, perforated lime trays, and hot and cold water and steam supply pipes. The mixture is pumped from the liming tube into filter-presses of the frame and plate type with side filling and arranged for complete washing with hot or cold water. The solution is treated with soda ash in wooden or iron tanks provided with agitators, and the calcium carbonate is separated by filter-presses. The weak soda liquors are concentrated in double or triple effect evaporators, which should have free and easy liquor circulation to prevent

scale formation and be provided with efficient save-alls. The strong liquor is pumped into a store tank having a steam heating coil and passes thence to a rotary drum dryer. The salt is then transferred by conveyors to large storage bins of iron. The cast iron fusion kettles are provided with powerful agitators, and heated, preferably, by oil burners. The fused product is ladled out and dumped directly into a dissolving trough through which water is circulated. The sodium phenoxide solution is decomposed with weak acid in iron or lead-lined tanks. The waste soda liquor is run to the sewer through a decanter tank to save phenol, and the crude phenol is run to the store tanks. The crude phenol is distilled by indirect steam in a vacuum still having a fractionating column and a dephlegmator, and connected by a silver or silver plated pipe with a tubular condenser having silver tubes. The distilled phenol is received in enamelled receivers, and all pipes and connections that come into contact with the finished phenol must be of silver or be silver plated. A complete plant to produce 10,000 lb. of phenol per day, with brick and steel buildings and power plant complete, is about \$200,000. A plant for 20,000 lb. per day cost about \$250,000.—W. H. C.

*β-Methylnaphthalene; Action of sulphur on* — under pressure. W. Friedmann. Ber., 1916, 49, 1352—1355.

CONTINUATION of the research on the action of sulphur on  $\alpha$ -methylnaphthalene (this J., 1916, 350) has shown that products free from sulphur or containing sulphur are obtained respectively according to whether the sealed tube is opened every 12 hours or allowed to remain sealed throughout the heating; by heating to 320° C. for 72 hours without opening the tube, a substance  $C_{12}H_{10}S_1$  (m.pt. 332° C.) was isolated.  $\beta$ -Methylnaphthalene gives under the same experimental conditions isomeric  $\beta$ -compounds, but an isomeric picene could not be obtained; after extraction of the melt with alcohol and benzene, a product  $C_{12}H_{10}S_1$  (m.pt. 350° C.), similar in appearance to picene and isomeric with the product of m.pt. 332° C. from  $\alpha$ -methylnaphthalene was obtained, and from the benzene extract a cyclic sulphur compound,  $C_{12}H_{14}S$  (m.pt. 167° C.) was isolated. —F. W. A.

*Distillation [cracking] of petroleum*. Selinsky. See II A.

*Thermal decomposition of the propane-butane fraction from natural gas condensate*. Zanetti. See II A.

#### PATENTS.

*Tar and similar substances; Distillation of* —. A. Leinweber, Chemnitz. Ger. Pat. 202,992, May 23, 1915.

IN the process of distilling tar or the like by forcing it through heated tubes under high pressure and then discharging it through a spraying device into a vaporizing chamber, the tar is diluted with lower-boiling hydrocarbons before introducing it into the heated tubes.—A. S.

*Pitch; Method of preventing caking of disintegrated* —. J. Alexander, Altona. Ger. Pat. 203,267, Oct. 23, 1915.

THE particles of pitch are coated with an oily substance which is non-volatile at temperatures to which the pitch will be exposed and which improves the binding power of the pitch or the calorific value of the briquettes prepared therefrom. Suitable substances are petroleum, naphthalene, and oil-gas tar.—A. S.

## IV.—COLOURING MATTERS AND DYES.

*Azo-compounds; Relation between the chemical constitution and colour of* —. A. C. Sircar  
Chem. Soc. Trans., 1916, 109, 757–776.

From a study of the colour of a number of azo-phenols, azonaphthols, and some new azo- $\alpha$ -anthrools, the preparation of which is described in detail, it is found that the longer the chain of alternate double and single bonds in that part of the molecule containing the auxochrome which proceeds from the auxochrome to the azo-linking by the longest possible route, the deeper is the colour. Thus benzeneazophenol with three double and two single bonds is yellow, whereas benzeneazo- $\alpha$ -naphthol with five double and four single bonds is orange-red, and benzeneazo- $\alpha$ -anthrol with seven double and six single bonds reddish-violet. The theory was further tested by the preparation of a number of benzeneazotetrahydro- $\alpha$ -naphthols, in which the chain of double and single bonds is the same as in the azophenols. These substances were all yellow and gave dyeings almost identical with those given by the corresponding azophenols. Similarly the benzencazoanthrools, having their longest possible conjugated chain similar to the azo- $\alpha$ -naphthols, gave dyeings of much lighter shades than the azoanthrools. A spectroscopic examination of these dyestuffs also showed that as the length of the conjugate chain is increased, the head of the absorption band is gradually shifted towards the red end of the spectrum.

—G. F. M.

*Xanthone derivatives and xanthone colouring matters.*

S. Dhar. Chem. Soc. Trans., 1916, 109, 744–760.  
The preparation and properties of mono-, di-, tetra-, and hexabromoxanthones, and  $\alpha$ - and  $\beta$ -dinitroxanthones, are described. Some anilino-derivatives of the bromoxanthones possessing dyeing properties have been prepared, for example, dianilinodibromoxanthone,  $C_{15}H_{10}O_2Br_2(NH_2)_2$ , was obtained as a bluish-black precipitate by boiling the tetrabromo-compound with aniline and a trace of copper powder. It gives blue shades on chrome-mordanted wool. Hexa-anilino-xanthone, similarly prepared from hexabromoxanthone, gives deep blue shades on chrome-mordanted wool, whilst phenyliniminodinitroxanthone,  $C_{15}H_{10}O_2(NO_2)_2$ ;  $NC_6H_5$ , from  $\alpha$ -dinitroxanthone and anilino dyes pale violet shades on tannin-mordanted cotton. Some azo-compounds were obtained from  $\beta$ -nitroaminoxanthone and  $\beta$ -naphthol, phenol, and 1,5-dihydroxynaphthalene, but their dyeing properties were of no special interest. Attempts to prepare vat dyes by the condensation of bromo- and amino-derivatives were not successful.—G. F. M.

*Sulphurylindoxyl; Action of halogen compounds on* —. Heterocyclic sulphones. IV. M. Claass. Ber., 1916, 49, 1408–1415. (Compare this J., 1916, 529.)

SULPHURYLINDOXYL possesses weak basic in addition to acid properties; the hydrochloride and the ammonium salt have been isolated. With benzoyl chloride sulphurylindoxylphenylketone (m.pt. 124°–125°C.) is obtained; acetyl chloride and ethyl chlorocarbonate act similarly, but ethylphenylurea chloride leads to the formation of di-sulphurylindoxyl-ketone (m.pt. 247°C.). Isato-sulphurylindoxyl (m.pt. 171°–172°C.) is obtained by the action of isatin chloride; this compound dissolves in cold caustic soda giving a solution of a deep blue colour similar to indigo in shade and strength; its hydrosulphite vat is colourless, but the dye-stuff is regenerated by exposure to air; it is very sensitive to acids.—F. W. A.

*Dyeing values of some [natural Indian] dyestuffs.* Srivastava. See VI.

## PATENTS.

*Dye or stain.* W. Somerville, Auburn, Victoria, Australia. U.S. Pat. 1,193,838, Aug. 8, 1916. Date of appl., Dec. 15, 1915.

A DYE or stain is obtained by treating the resin of the grass tree (*Xanthorrhoea*) with a solution of an alkali and concentrating the mixture to the required consistency; it may be used in conjunction with mordants.—F. W. A.

*Phthaleine dyes; Manufacture of* —. H. Inrie, London. From J. R. Geigy A.-G., Basle, Switzerland. Eng. Pat. 16,725, Nov. 26, 1915. See Ger. Pat. 290,508 of 1915; this J., 1916, 532.

*Phthalein dye and process of making the same.* H. Hagenbach, Assignor to J. R. Geigy, Basle, Switzerland. U.S. Pat. 1,194,380, Aug. 15, 1916. Date of appl., Nov. 17, 1915.

See Ger. Pat. 290,508 of 1915; this J., 1916, 532.

*Disazo dyestuffs and process of making the same.* R. Schüle, Frankfort, Germany, Assignor to Cassella Color Co. U.S. Pat. 1,193,829, Aug. 8, 1916. Date of appl., Oct. 8, 1914.

See Eng. Pat. 28,925 of 1913; this J., 1915, 800.

## V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

*Sulphite-cellulose waste lyes; Treatment and utilisation of* —. J. König. Z. Unters. Nahr. Genussm., 1916, 31, 171–176. Z. angew. Chem., 1916, 29, Ref. 379.

To render sulphite-cellulose waste liquor suitable for feeding to cattle, it is neutralised with lime, oxidised by allowing it to trickle over galvanised wire gauze, again neutralised by passing it over limestone, and then allowed to trickle over a bed of porous brick coated with manganese peroxide. The purified liquor is concentrated to a thin syrup by indirect heating with steam, the syrup is mixed with dry feeding stuffs (bran, malt counts, dried brewers' grains, etc.), and the mixture dried until the water-content is reduced to 10–12%. —A. S.

*Extraction of rosin from wood. Experiments using a petroleum solvent.* Palmer and Boehmer. See XIII.

*Decomposition of cellulose in soils.* McBeth. See XVI.

## PATENTS.

*Fibrous materials; Method of treating* —. E. D. Jefferson, Boston, Mass. U.S. Pat. 1,192,903, Aug. 1, 1916. Date of appl., Jan. 18, 1915.

FIBROUS material is placed in a closed vessel containing an alkaline liquor, the air is expelled by steam, and the material, the various parts of which are retained in the same relative position, is alternately and repeatedly immersed in the boiling liquid and withdrawn into the atmosphere of steam above it.—J. F. B.

*Cellulose acetate; Use of amyl acetate for solutions containing* —. L. J. Riley, London. Eng. Pat. 15,428, Nov. 2, 1915.

CELLULOSE acetate which is insoluble in amyl acetate is dissolved in a solvent and amyl acetate is added to the solution in proportion determined by previous experiment. *Example:*—Cellulose acetate, 8 parts, is dissolved in 40 parts by weight of acetone and 42 parts of amyl acetate added.

—J. F. B.

*Cellulosic compositions.* H. S. Mork, Brookline and G. J. Esselen, jun., Swampscott, Mass., Assignors to Chemical Products Co., Boston. U.S. Pat. 1,193,178, Aug. 1, 1916. Date of appl., Apr. 29, 1916.

The composition contains a cellulose ester (e.g., acetate), triphenyl phosphate, and phenyl salicylate.—J. F. B.

*Paper pulp; Method and means for testing.* M. Riegler, Unterkochen, Assignor to L. Schopper, Leipzig, Germany. U.S. Pat. 1,193,613, Aug. 8, 1916. Date of appl., Sept. 8, 1913.

The apparatus consists of a hopper with a perforated bottom and a container with sloping walls attached underneath the hopper. Several outlets are provided in the container at different heights, each delivering water to separate collecting vessels. The quality of the pulp, as shown by the rate of draining, is indicated by the relative quantities of water collected in the several vessels.—J. F. B.

*Fibrous caps for bottles and other containers; Manufacture of.* A. Westlake, New York. Eng. Pat. 18,148, Nov. 16, 1915.

SEE U.S. Pat. 1,160,478 of 1915; this J., 1915, 1244. (Reference is directed, in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pats. 2604 of 1867 and 17,883 of 1899.)

*Celloidin; Product resembling — and process for producing the same.* L. Lederer, Sulzbach, Germany. U.S. Pat. 1,195,040, Aug. 15, 1916. Date of appl., May 2, 1907. Renewed July 1, 1916.

SEE Fr. Pat. 377,010 of 1907; this J., 1907, 1027.

*Method of refining wool grease. Method of treating [bleaching] wool grease.* U.S. Pats. 1,194,013—1,194,015. See XII.

## VI.—BLEACHING; DYEING; PRINTING; FINISHING.

*Dyeing values of some [natural Indian] dyestuffs. II.* J. P. Srivastava, Agric. J. India (Indian Scient. Congress, Special Number), 1910, 53—64.

The dyeing values of eight further indigenous dye materials (compare this J., 1915, 606) have been examined. Kachnar (*Bauhinia racemosa*) bark is available in quantity for dyeing dull red shades on cotton; faster dyeings are obtained on alumina or tin mordant. Peepul (*Ficus religiosa*) gives good pink shades on alumina-mordanted cotton. Sanderswood (*Pterocarpus santalinus*) dyes un-mordanted wool and fast red shades are obtained with cotton on tin and alumina mordants; the dye is insoluble in water, but freely soluble in alcohol, ether, and acetic acid. Roli or Kamela powder (*Mallotus philippinensis*) gives in an alkaline bath a shade similar to Chrysophenine on alumina-mordanted silk. Akhrot (*Juglans regia*) bark yields a valuable brown dye, the shade of which on wool can readily be modified to khaki; the deepest shade is obtained by dyeing with 3% of acetic acid in the dye-bath, but is not fast to light; fairly full shades are obtained on chrome-oxalic acid mordant or by the after-chroming process, the dyeings being of excellent fastness to light and to milling. Kathal (*Artocarpus integrifolia*) wood yields a dye which gives fast yellow dyeings on alumina-mordanted cotton. Barberry (*Rhamnus*) bark, roots, and stem contain a large amount of a good yellow dye for silk; dull shades are obtained on alumina-mordanted cotton. *Rhus colinus* wood yields a dye similar to young Fustic; orange shades are obtained on alumina-mordanted

cotton and redder shades on tin-mordanted cotton, but the dyeings are not fast to alkali or soap.

—F. W. A.

## PATENTS.

*Dyeing and other treatment of fibrous materials; Method of.* J. R. and H. G. Dyson, Huddersfield. Eng. Pat. 12,010, Aug. 20, 1915.

The fibrous materials are placed on a tightly fitting removable perforated false bottom in the vat round a central tube up which steam draws the liquor from the bottom of the vat; the liquor impinges against an adjustable spreader and is distributed over the materials until dyeing is complete; the steam is then shut off, the spreader screwed down so as to form a tight joint with the top of the central tube, and air or steam and air is blown into the upper part of the vat and passes through the material, acting as an oxidising agent, and also extracting the surplus dye liquor; the materials may then be washed, the whole process being completed without removing the lid of the vat. The same apparatus may be adapted for dyeing by the cold process by combining with it a pump for exhausting the dye-liquor from the vat.

—F. W. A.

*Dyeing, scouring, and washing wool and other fibrous materials; Machines for.* J. and R. Whitaker, Dewsbury. Eng. Pat. 101,060, Mar. 17, 1916. (Appl. No. 3959 of 1916.)

In a machine for dyeing, scouring, and washing wool, etc., consisting of a fixed outer vat fitted with a movable inner chamber with a perforated false bottom, steam and heated air under pressure are delivered alternately and uniformly beneath the false bottom, the liquor is drawn off through a bottom outlet pipe and forced by means of a pump into the top of the machine (above the normal level of the liquor) through a side-perforated horizontal pipe across the inner chamber, and the movable inner chamber is arranged for a side-tip discharge.

—F. W. A.

*Weighting silk; Metal-chloride bath for.* P. Schmid and K. Gross, Basel, Switzerland. U.S. Pat. 1,193,429, Aug. 1, 1916. Date of appl., Oct. 7, 1915.

SEE Ger. Pat. 291,009 of 1915; this J., 1916, 596.

*Dyeing bath for silk; Foam or froth.* P. Schmid and K. Gross, Basel, Switzerland. U.S. Pat. 1,193,430, Aug. 1, 1916. Date of appl., Oct. 7, 1915.

SEE Eng. Pat. 100,330 of 1916; this J., 1916, 630.

*Dyesuffs [on the fibre]; Compounds for use in the production of.* F. Kunert, Offenbach, Assignor to Chem. Fabr. Griesheim-Elektron, Frankfort, Germany. U.S. Pat. 1,193,560, Aug. 8, 1916. Date of appl., Apr. 23, 1915.

SEE Eng. Pat. 6663 of 1915; this J., 1916, 304.

## VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

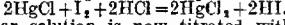
*Nitrosylsulphuric acid (nitrosulphonic acid); Tautomerism of.* J. Biehringer and W. Borsum, Ber., 1916, 49, 1402—1406.

FROM a survey of the literature referring to the constitution to be attributed to  $\text{HSO}_2\text{N}$ , the authors conclude the substance is to be regarded as possessing the two formulae:  $\text{HO}\text{SO}_2\text{NO}_2$  and  $\text{HO}\text{SO}_2\text{O}\text{NO}$ , being tautomeric. In support of this conclusion it has been found that this compound yields with dimethylaniline a mixture of *p*-nitro- and *p*-nitrosodimethylaniline; the yield

of the nitroso-compound decreased with rise of temperature, whereas the yield of nitro-compound increased; it was shown that this increase is not due merely to oxidation of the nitroso-compound, but is caused by tautomeric change of the nitrosyl-sulphuric acid to nitrosulphonic acid.—F. W. A.

*Formic acid; Determination of — in pure solutions and in urine, together with a new method for the titration of calomel.* O. Riesser. *Z. physiol. Chem.*, 1915, **96**, 355—366. *J. Chem. Soc.*, 1916, **110**, ii, 455.

The solution (30 c.c.) containing the formic acid (10—20 mgrms.) is heated with a considerable excess of a solution containing 200 grms. of mercuric chloride, 300 grms. of sodium acetate, and 80 grms. of sodium chloride per litre for six hours on the water-bath. The mixture is then cooled and, without filtering from the precipitated calomel, treated with 10 c.c. of 25% hydrochloric acid, then excess of concentrated aqueous potassium iodide (4 grms. of potassium iodide for every 10 c.c. of the above mercuric chloride solution added to the formic acid solution), followed by an excess of *N*/10-iodine solution. The calomel is thereby quantitatively reconverted into mercuric chloride according to the equation



The clear solution is now titrated with *N*/10-thiosulphate solution, employing starch as indicator in the usual way. The number of c.c. of *N*/10-iodine solution required to transform the calomel into mercuric chloride multiplied by 0.0023 represents the amount of formic acid in grams present in the volume of the solution taken for the analysis. In the absence of sodium chloride or a corresponding salt, the formic acid reduces a portion of the mercuric chloride to metallic mercury, whereby gross error in the estimation of the formic acid may be entailed; close adherence to the above conditions is therefore necessary.

*Soda and alkaline water; Natural — from East Mongolia.* T. Suzuki. *J. Chem. Ind.*, Tokyo, 1916, **19**, 631—641.

THE water of Lake Tafusu (96 sq. km. area) was found to contain  $\text{Na}_2\text{CO}_3$  1.31,  $\text{NaCl}$  2.27, and  $\text{Na}_2\text{SO}_4$  0.68%. A surface deposit due to evaporation of a shallow lake in the Poli valley during the dry winter season contained  $\text{Na}_2\text{CO}_3$  12.04,  $\text{NaCl}$  1.45, and  $\text{Na}_2\text{SO}_4$  0.75%.—W. R. S.

*Calcium acid carbonate; Composition and solubility of —.* A. Cavazzi. *Gaz. Chim. Ital.*, 1916, **46**, II, 122—135.

EXPERIMENTAL proof is given that the salt formed by the action of excess of carbon dioxide on lime water, or by the action of water containing carbonic acid on normal calcium carbonate, is actually the bicarbonate,  $\text{Ca}(\text{HCO}_3)_2$ . The maximum quantity of calcium carbonate dissolved by prolonged agitation (not less than 10 hours) in 1 litre of water saturated with carbon dioxide and kept in contact with carbon dioxide at atmospheric pressure is 1.56 grms.  $\text{CaCO}_3$  at 0°C. and 1.1752 grms. at 15°C. By passing a strong current of carbon dioxide into lime water saturated at 15°C., an unstable supersaturated solution of calcium bicarbonate containing 2.29 grms.  $\text{CaCO}_3$  per litre can be obtained.—A. S.

*Nitrous oxide, air, and water vapour in mixtures of these constituents; Determination of —.* G. A. Burrell and G. W. Jones. *J. Ind. Eng. Chem.*, 1916, **8**, 735.

THE apparatus used is the same as that described previously (this J., 1915, 895). The gas is introduced at atmospheric pressure and after cooling by means of liquid air for 10 mins., the air is withdrawn by means of a Töpler pump and measured;

at the temperature of liquid air the vapour pressure of nitrous oxide is negligible. The bulb containing the liquefied gas is next immersed in a mixture of solid carbon dioxide and acetone (−78°C.) and after 10 mins. the nitrous oxide is pumped off and measured; the vapour pressure of water is inappreciable at this temperature. The bulb is now removed from the cooling mixture and the amount of water vapour determined from its partial pressure by means of the attached manometer.—A. S.

*Iodine and starch iodide in aqueous media; Action of light upon —.* H. Bordier. *Comptes rend.*, 1916, **168**, 205—206.

AQUEOUS solutions of iodine and of starch iodide contain these substances in a colloidal form, and if a very dilute solution of iodine (13 mgrms. per litre) or starch iodide be exposed to light for some hours, the yellow or blue colour disappears and the liquid becomes acid. The decolorised iodine solution does not react with starch, and the decolorised starch iodide becomes blue on the addition of a little iodine. These phenomena are explicable on the assumption that the ionising action of violet and ultraviolet rays causes the electrically charged colloidal particles to lose their charges, thereby causing them to acquire chemical properties which they did not possess in colloidal solution. They then react with the hydrogen of the water to form hydroiodic acid. The yellow glass used for bottles in which substances are preserved from the action of light, was found to be quite transparent to the rays which decompose starch iodide.—E. H. T.

*Investigation of the "chromate" method for separating the alkaline earths.* Vickery. See XXIII.

#### PATENTS.

*Oxalic acid; Process for the production of —.* C. T. Thorsell and H. L. F. Lundén, Gothenburg, Sweden. Eng. Pat. 11,487, Aug. 9, 1915.

In the production of oxalic acid from sodium oxalate containing sodium carbonate and hydroxide, the material is first treated with a solution containing sodium bisulphate and sulphuric acid to obtain acid sodium oxalate and normal sodium sulphate. The acid oxalate is then washed with water and treated with sulphuric acid to produce oxalic acid and a solution containing sodium bisulphate and sulphuric acid, which solution is used for treating a fresh portion of original material after the latter has received a preliminary treatment with either the wash water of the acid sodium oxalate or the mother-liquor from the crystallisation of the sodium sulphate produced in the process.—W. E. F. P.

*Acids [nitric and hydrochloric]; Process of making mineral —.* H. Howard, Brookline, Mass. U.S. Pat. 1,193,552, Aug. 8, 1916. Date of appl., July 13, 1914.

In the manufacture of nitric and hydrochloric acids from sodium nitrate and chloride, adjustment between the respective furnaces (of which the hydrochloric acid furnace has a greater capacity than the nitric acid furnace) is effected by mixing the sodium bisulphate obtained in the nitric acid process with an excess of sodium chloride and sufficient sulphuric acid to produce normal sodium sulphate, and heating the mixture in the hydrochloric acid furnace.—W. E. F. P.

*Acetic acid; Production of concentrated from dilute —.* Harburger Chem. Werke Schön und Co., Harburg. Ger. Pat. 292,959, Jan. 6, 1915.

THE dilute acid is treated with sufficient potassium acetate to form double compounds of potassium acetate and acetic acid which separate from the

solution. These are removed and the acetic acid recovered in a concentrated condition by distillation. The potassium acetate may be partially replaced by other salts, especially those capable of acting as dehydrating agents, *e.g.*, calcium chloride.—A. S.

*Alumina and soda from bauxite residues; Obtaining* —. J. H. Ramsay and F. R. Lowe, Low Fell, Durham. Eng. Pat. 9705, July 3, 1915.

BAUXITE residues from which the greater part of the alumina has been extracted, contain up to 25%  $Al_2O_3$  as double silicate with soda. By treating the residues with wet or dry carbon dioxide the alumina and soda are rendered soluble.—W. E. F. P.

*Copper sulphate and other dry hydrated salts; Manufacture of* —. T. Pedder, Widnes. Eng. Pat. 11,298, Aug. 5, 1915.

THE crystals to be dried are maintained at a suitable temperature in a current of air and kept in motion by a worm conveyor or similar means, so as continually to expose fresh surfaces.—B. V. S.

*Zinc chloride; Manufacturing* —. W. H. Biggs, Mumbles, Glamorgan. Eng. Pat. 11,031, July 29, 1915.

ZINC oxide—obtained by roasting or calcining blende or other zinc ore—is intimately mixed with common salt or other chloride, the mixture heated to about  $700^{\circ}C$ . in a closed vessel, and the vapour of zinc chloride condensed.—W. E. F. P.

*Ammonia; Production of* —. C. T. Thorsell, Gothenburg, Sweden. Eng. Pat. 11,486, Aug. 9, 1915.

In the production of ammonia by heating barium cyanide with water in an autoclave, the residue obtained (containing barium formate) is treated with sodium carbonate to produce barium carbonate and a solution of sodium formate. The latter is evaporated *in vacuo* to obtain a salt from which sodium oxalate may be subsequently produced; while the former is heated with coal and nitrogen to regenerate barium cyanide.—W. E. F. P.

*Ammonia; Method of oxidising* —. Process and apparatus for oxidising ammonia. Catalyst apparatus for oxidising ammonia. Platinum catalyst. Catalyst for oxidising ammonia. W. S. Landis, Niagara Falls, N.Y., Assignor to F. S. Washburn, Nashville, Tenn. U.S. Pats. (A) 1,193,796, (B) 1,193,797, (C) 1,193,798, (D) 1,193,799, and (E) 1,193,800, Aug. 8, 1916. Dates of appl. (A) and (B) Feb. 20, 1915 (C), (D) and (E) Jan. 27, 1916. (A) Renewed June 15, 1916.

(A) and (B). AMMONIA is mixed with air in suitable proportion and passed through a catalytic mass maintained at a uniform temperature above  $500^{\circ}C$ .; a cooling appliance is arranged so as to prevent the mixture of gases being heated before it reaches the catalyst. (C) The catalyst is powdered and contains embedded in it an iridium-free platinum wire heated by a controlled electric current. (D) and (E). The catalyst is composed of uniform, fine, iridium-free platinum wire in the form of a grid or gauze and heated by a controlled electric current.—B. V. S.

*Carbides; Production of* —. Alby United Carbide Factories, Ltd., London, and K. Hylland, Odda, Norway. Eng. Pat. 14,486, Oct. 13, 1915. Under Int. Conv., Oct. 31, 1914.

CLAIM is made for an intermediate product (in the manufacture of calcium carbide) obtained by coking a mixture of lime or limestone and caking coal at above  $700^{\circ}C$ . The product has powerful reacting properties and no tendency to crumble or powder.—W. E. F. P.

*Table salt from rock salt; Process for making* —. Gewerkschaft "Einigkeit I," Ehmen, Germany. Eng. Pat. 18,125, Dec. 29, 1915. Under Int. Conv., Jan. 22, 1915.

A NON-CAKING and non-hygroscopic table salt is prepared by moistening powdered rock salt with a saturated solution of pure sodium chloride and drying the product.—W. E. F. P.

*Sodium percarbonate; Manufacture of* —. Henkel und Co., Düsseldorf, Germany. Eng. Pat. 100,997, Apr. 8, 1916. (Appl. No. 5185 of 1916.) Under Int. Conv., Aug. 18, 1915.

"SODIUM percarbonate,  $2Na_2CO_3 \cdot 3H_2O_2$ ," is obtained by treating sodium carbonate with an aqueous solution of hydrogen peroxide in the proportion of not less than 3 mols. of the latter to 2 mols. of the former; the process is conducted at about  $0^{\circ}C$ . and the product dried in a vacuum. The specified quantities of sodium carbonate and hydrogen peroxide may be partly or entirely produced from suitable reaction components in aqueous solution, *e.g.*, from sodium bicarbonate and a mixture of sodium peroxide and sulphuric acid respectively.—W. E. F. P.

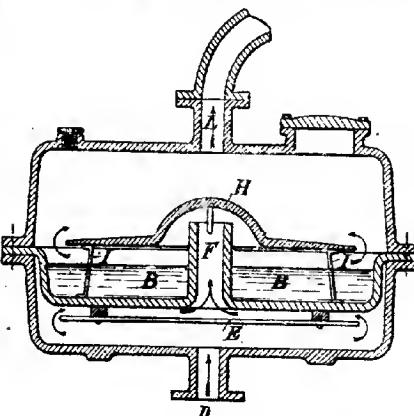
*Chromium-containing [base-exchanging] silicates; Process of producing* —. Process of base exchange. [Purification of water.] A. Kolb, Charlottenburg-Westend, Germany. Assignor to The Permutit Co., New York. U.S. Pats. (A) 1,193,794 and (B) 1,193,795, Aug. 8, 1916. Date of appl., Mar. 28, 1916.

(A) A SOLUTION, which may be alkaline, containing chromium, is precipitated with an alkaline solution of silica, and the precipitate washed, pressed, and dried. (B) The liquid, *e.g.*, water, to be treated or purified, is passed through a bed of hard granular material which contains chromium, alkali, silica, and water, and may also contain a catalyst.

—B. V. S.

*Sulphur dioxide and nitrogen; Manufacture of a mixture of* —, and apparatus therefor. L. Descamps, Chateauneuf, France. Eng. Pat. 100,939, Jan. 21, 1916. (Appl. No. 1010 of 1916.) Under Int. Conv., July 18, 1915.

DRY, preheated air is completely deprived of oxygen by contact with a large surface of molten sulphur. In the apparatus employed (see fig.),



dry air entering at the opening, D, is preheated by passing successively below and above the baffle-plate, E, and through the pipe, F, and is then deflected on to the surface of the molten sulphur, B, by the circular cap, H, supported on the tripod,

I. The mixture of sulphur dioxide, nitrogen, and sulphur vapour thus produced is conducted through the exit, L, to an apparatus for condensing sulphur vapour. The mixture of sulphur dioxide and nitrogen is suitable for use in the manufacture of hydrosulphites.—W. E. F. P.

*Carbon bisulphide; Manufacture of* —. A. Walter, Ardsley, N.Y. U.S. Pat. 1,193,210, Aug. 1, 1916. Date of appl., Sept. 23, 1913; renewed Jan. 6, 1916.

HYDROGEN sulphide, "evolved in a retort containing highly heated carbon and fed with sulphur," is passed through a retort containing highly heated carbon to produce carbon bisulphide.—W. E. F. P.

*Javel water [hypochlorite solution]; Solid product intended for use in the preparation of* —. F. A. Bonnau, Suresnes, France. Eng. Pat. 11,587, Aug. 10, 1915. Under Int. Conv., Jan. 14, 1915.

SEE Fr. Pat. 477,691 of 1915; this J., 1916, 601.

*Process of recovering water-soluble potassium salts from felspathic rocks or their derivatives in the manufacture of Portland cement*. U.S. Pat. 1,194,344. See IX.

### VIII.—GLASS; CERAMICS.

*Clay wares; Casting of* —. T. G. McDougal. U.S. Bureau of Mines. Technical Paper 126, 26 pages.

THE chief difficulties in casting pottery arise from variations in the composition of the slip used, improper preparation of the slip, poor selection of the clays, and an improper condition of the moulds. The casting properties of a clay are due to the proportion of colloidal clay present, and it is usually necessary to diminish the amount of gel in the clay so as to reduce the plasticity of the slip and make the cast clay open enough to permit a free passage of the water from the slip to the mould. When the ware is of simple design, the proportions of ball and china clays should be reduced to a minimum, using instead scrap ware which has been heated in the drying room so that the gel in it is "set" and rendered innocuous. When raw clays must be used, the colloidal content can be controlled by adding certain soluble salts such as sodium carbonate or sodium silicate. On adding a small quantity of a concentrated solution of sodium carbonate to a clay slip and stirring thoroughly, the slip becomes very thin, but on continued addition of the solution the slip begins to thicken again and may become very viscous. Very small amounts of sodium carbonate are required, the maximum thinning effect in a porcelain body slip being attained with 0.8 gram. per litre of slip. The proportion required depends on the concentration of the sodium carbonate in the water present in the slip and not on the amount of clay present. Sodium silicate behaves similarly, but the approach to a maximum effect is more gradual, the minimum viscosity being obtained with a concentration of 1.6 grms. of silicate of 40° B. (sp.gr. 1.375) containing 41.6% of dry sodium silicate, per litre of slip. In commercial practice, mixtures of carbonate and silicate are used, as the former does not give the necessary bonding power to the slip. The most suitable proportions are determined by tests in a simple flow viscometer. If too large a proportion of soluble salts is present, the slip will cast rapidly at first but will soon stop, and a thick piece of ware cannot be made. Mixtures of two clays (such as Georgia kaolin and English china clay) do not give viscosities intermediate between the figures for each clay separately. Georgia kaolin thickens the china clay and Florida kaolin renders it thinner, possibly on account

of the variations in salts present in each. In making thick ware it was found impossible to use china clay alone, and the addition of English ball clay proved better than that of Tennessee ball clay for the purpose. Increasing the temperature of the slip has the same effect as adding more salts.

The author recommends that the clays should first be mixed with the amount of water required for the whole of the materials, the salts being added first and then the clays. The felspar, flint, and any other non-plastic ingredients are only added when the clays have been made into a uniform slip, as if all the ingredients are added together, a much larger proportion of water will be needed, and this causes difficulties. Care should be taken that variations in the moisture content of the materials are allowed for, as it is important to keep the composition accurate within very narrow limits. The mixing must be very thorough; it may be performed satisfactorily in a hulnger. The weight per pint of the casting slip should be kept constant and the temperature should not vary greatly. If scrap body is used it must be dried thoroughly first, as moist scrap introduces serious variations in the moisture content of the slip. The effect of drying the clay is to render the silicate inactive, and also to "set" some of the natural gel in the clay. Drying may also cause a partial removal of some of the soluble salts. These variations must be counteracted by adjusting the amount of salts added to the scrap clay. When no variations occur in the ingredients of the slip and in its weight per pint, viscometer readings afford an effective check on its general properties. The moulds used should be made of thick plaster; 200 to 300 pieces should be obtained from a mould before it is worn out. After fifty pieces have been made, the inside of the mould should be scraped so as to remove any saline deposit on it, and after each piece is withdrawn the mould should be wiped with a cloth. Excessively dry moulds are not satisfactory. The dried ware must be cleaned so as to remove any scum formed by the soluble salts in the slip, or the burned ware will have slightly glossy patches on it. Blisters may be due to the same cause.—A. B. S.

*Refractory firebricks; Practical methods for testing* —. C. E. Nesbitt and M. L. Bell. Amer. Soc. for Testing Materials, June, 1916. Met. and Chem. Eng., 1916, 15, 205—212.

TESTS should be made on bricks taken at random and not on specially prepared test pieces. They must be conducted at temperatures bearing some relationship to those in commercial furnaces, e.g. the upper part of a blast furnace is about 260° C. whilst 1350° C. is above the melting point of cast iron, and is in other ways a suitable temperature at which to make tests. The following tests have been developed mainly with reference to bricks to be used in iron and steel plants, but may be modified so as to be applicable to almost any conditions of service. *Impact test.* Before testing the brick is heated to 260° C. in 1 hour and kept at that temperature for 3 hours. A steel ball, 24 in. diameter, weighing 2.34 lb., is dropped on the end of the brick from a height of 2 in., 4 in., and so on, until the brick shows a fracture radiating 1 in. or more from the point of contact. The ball falls between two vertical and parallel angle irons, so that it may travel freely with not more than  $\frac{1}{4}$  in. clearance. The ends of the bricks are ground parallel and at right angles to the angle irons. The brick is supported on a steel block 6  $\frac{1}{2}$  in. by 15 in. by 12 in. *Abrasion test.* The brick is heated slowly to 1350° C. and kept at that temperature for 3 hours, and one end is then pressed under a constant pressure of 10 lb. per sq. in. for exactly 5 minutes against a vertical carborundum wheel,

18 in. diameter with 2 in. face, grit 10, grade J, revolving at a surface speed of 1040 ft. per min. The depth of the cut is regarded as a measure of the abrasion. Some bricks give different results when both ends are tested. *Spalling test.* The brick is dried thoroughly, weighed, and placed in the doorway or wall of a furnace so that one end is exposed for one hour to a temperature of 1350° C., this end being flush with the wall. The brick is then plunged to a depth of 4 in. in 2 galls. of water for 3 minutes. After heating and cooling in this way ten times, the bricks are dried at 100° C. for at least 5 hours, all particles which can be easily broken off with the fingers are removed, and the bricks are re-weighed. The percentage loss in the weight of the brick is regarded as a measure of the spalling. This test is only applicable to fireclay bricks. *Slagging test.* The use of kaolin rings to confine the slag was unsatisfactory, and it was found necessary to drill a circular cavity, 2½ in. diam. and ½ in. deep at the sides in the brick, the cutting edges of the drill enclosing an angle of 150°. The brick is heated to 1350° C., 35 grms. of slag ground to pass a 40-mesh sieve is placed in the cavity, and the heating is continued for 2 hours. The brick is allowed to cool, and is then sawn through the centre of the drilled cavity by means of a carbonised wheel, ½ in. thick, grit 10. The area penetrated by the slag is measured with a planimeter. *Compression test.* The brick is heated slowly to 1350° C., and is then maintained at that temperature for 3 hours; it is removed from the furnace, and a 2½ in. steel ball forced into it by means of a weighted lever of the second order consisting of a 4 in. I-beam 10 ft. long; the brick is placed 6 in. from the fulcrum, and a spherical depression in the beam marks the location of the ball. The lever alone applies a pressure of 850 lb. on the ball, and sand is run into a bucket at the end of the lever at the rate of 25 lb. per second so as to produce a total load of 1600 lb. on the ball. After 5 mins. the pressure is released, the brick removed and allowed to cool. The depth of the impression is measured with a micrometer gauge when the brick is cold. *Expansion, contraction, and fusibility* are determined by the usual methods. *Apparent specific gravity* is determined by weighing and measuring the brick, and not by suspension in water. It depends partly on the percentage of moisture in the material used for making the bricks, and on the pressure employed in shaping them. Power-pressing up to 1500 lb. per sq. in. improves the quality of fireclay bricks.—A. B. S.

*Sulphur-yellow sharp-fire colours for hard porcelain.* T. Hertwig, Sprechaal, 1916, 49, 120. Z. angew. Chem., 1916, 29, Ref., 378.

COMMERCIAL cerium phosphate when melted with basic fluxes gives yellow to greenish-yellow colours suitable for hard porcelain. Mixtures containing potash or lead oxide are characterised by pure sulphur-yellow tints; frits prepared from mixtures of the composition  $2\text{KNO}_3 + \text{SnO} + \text{CePO}_4$ , and  $\text{PbO} + \text{SnO} + \text{CePO}_4$  are free from any tinge of green. By addition of other metallic oxides orange tints can be obtained.—A. S.

#### PATENTS.

*Vitreous bodies; Methods of making*—. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 15,895, Nov. 6, 1915.

VITREOUS rods, tubes, and other articles of extended shape are made of two ingredients in such a manner that the composition of the article varies gradually from one end to the other. The two ingredients (such as quartz and borosilicate glass

of low expansion) are placed side by side in a trough fitted with a diagonal partition which is arranged so that taken transversely the two ingredients are in the desired proportions. The partition is then removed and the material is stirred transversely to the length of the trough so as to produce a mixture which is homogeneous on a transverse section but retains its predetermined longitudinal variation in composition. To form a tube the mixture is then transferred to a mould containing a core, by tilting the trough on its long axis without disturbing the composition of the mixture. The material is sintered by heating it electrically to 1300°—1400° C. for 1½ mins. The invention is specially applicable to the joining of two materials, such as silica and glass, which have different coefficients of expansion, and for making gas-tight seals in silica containers. Such a seal is made by fusing the silica-end of a rod of the material on to the end of a silica tube and working the molten material so as to close the tube. A metallic conductor may be embedded in the fused glassy end of the seal.—A. B. S.

*Glass furnace.* M. K. Holmes, Assignor to Hemingray Glass Co., Muncie, Ind. U.S. Pat. 1,193,788, Aug. 8, 1916. Date of appl., June 8, 1914.

AT the delivery end of the furnace the floor is raised above the level of the main bed but is below the normal level of molten glass. On this raised portion are platforms with their upper faces above the normal glass level and separated laterally so as to form a channel in line with an outlet opening in the end wall of the furnace, which opening is covered by a flow block having a discharge opening in its bottom.—A. B. S.

*Leer [for annealing glass].* J. Rau, Indianapolis, Ind. U.S. Pat. 1,195,987, Aug. 15, 1916. Date of appl., Feb. 12, 1916.

A LONGITUDINAL heating chamber has a false floor with openings at intervals, and a perforated conveyor to carry the glass-ware. Hot gases enter at the front of the chamber and are drawn off at the back and also through the openings in the conveyor and floor, into a longitudinal flue beneath.

—A. B. S.

*Mica; Process of splitting*—. H. R. Edgecomb, Edgewood Park, Pa., Assignor to Westinghouse Electric and Manufacturing Co. U.S. Pat. 1,194,155, Aug. 8, 1916. Date of appl., July 24, 1912.

MICA blocks are split by heating them and subsequently applying a stream of liquid to the edges, the blocks being bent before or after the application of the liquid.—A. B. S.

*Clay articles; Manufacture of*—. J. C. Quinin, Assignor to The Acme Furnace Equipment Co., New York. U.S. Pat. 1,193,922, Aug. 8, 1916. Date of appl., June 15, 1911.

CLAY articles are burned by forcing air through a bed of fuel into the kiln and simultaneously withdrawing the flue gases through the chimney, the forced and induced draughts being adjusted to the conditions desired.—A. B. S.

#### IX.—BUILDING MATERIALS.

*Plaster; Chemical examination of*—. A. Cavazzi. Annali Chim. Appl., 1916, 6, 18—26. (See this J., 1913, 328.)

SODIUM chloride in crude gypsum may be determined by Mohr's method applied directly to the aqueous extract. In the case of plaster of Paris,

it is necessary to treat the solution first with carbon dioxide at the ordinary temperature to convert free lime into bicarbonate and decompose any sulphide present; after boiling to decompose the bicarbonate and expel hydrogen sulphide, and concentrating, Mohr's method may be applied. To determine sodium sulphate in crude gypsum, an aqueous extract of the finely powdered mineral is treated hot with excess of barium hydroxide solution, the precipitate of barium sulphate and magnesium hydroxide filtered off, and the solution treated with carbon dioxide to convert into bicarbonates the hydroxides of calcium, barium, and sodium present in the solution. The bicarbonates are then decomposed by boiling, the calcium and barium carbonates filtered off, and the sodium carbonate, equivalent to the sodium sulphate originally present, is titrated with hydrochloric acid. Magnesium sulphate is determined by precipitating the magnesium as magnesium ammonium phosphate after removing the calcium as oxalate. Carbonic acid is determined by the method described previously (this J., 1915, 1206). Free lime in plaster is determined by titration of the aqueous extract with hydrochloric acid; if sulphide is present, as indicated by a brown colour or precipitate on adding silver nitrate, it must be oxidised to sulphate by boiling with a small quantity of hydrogen peroxide before titrating.

—A. S.

*Flooring; Composition [Sorel cement].*—, R. R. Shively. J. Ind. Eng. Chem., 1916, **8**, 679–682.

CONSIDERABLE difficulty has been experienced in the use of Sorel cement in the United States, and has been sometimes attributed to the sudden changes of temperature encountered. The results of the author's investigation show, however, that the principal causes of failure are the use of improper mixtures and the lack of care in application. To obtain good results with composition flooring of the Sorel cement type, control of both the chemical composition and the manipulation of the mixture is necessary. The composition must be modified to suit particular cases, but excellent results have been obtained in practice with a mixture of 40% of magnesia, 20 of clay, 12 of Venetian red, 10 of sawdust, 8 of *terra alba*, and 10% of magnesium chloride. The magnesia and fillers are mixed, incorporated with magnesium chloride solution, and water added to give the proper consistence.—A. S.

#### PATENTS.

*Building material. [Artificial stone.]* K. Ogawa, Tokyo, Japan. Eng. Pat. 13,075. Sept. 13, 1915.

DOLOMITE is burned at 700°–800° C. so as to decompose the magnesium carbonate but not the calcium carbonate present. The product is reduced to a fine powder and is mixed with 15–25% of its weight of cork or sawdust and 50% of magnesium chloride solution (18° B., sp.gr. 1.14), and kneaded into a plastic mass which is then allowed to set into hard and strong but light body. This body is coated with a facing material composed of burned dolomite powder 100, pigments 5–10, magnesium chloride solution 33 parts, with a suitable quantity of slag, wool or asbestos. The material may be made into tiles or used for coating walls, floors, etc.—A. B. S.

*Potassium salts; Process of recovering water-soluble — from felspathic rocks or their derivatives in the manufacture of Portland cement.* F. W. Huber and F. F. Reath, Riverside, Cal. U.S. Pat. 1,194,344, Aug. 8, 1916. Date of appl. Jan. 26, 1916.

THE rock and a calcareous material are mixed in proportions suitable for forming Portland cement,

and the mixture is heated with an insoluble haloid salt (fluoride) of an alkaline-earth metal to about 950° C. until the greater part of the potassium has been volatilised. The potassium fluoride is collected, and treated with a solution of the alkaline-earth compound to regenerate the fluoride for re-use in the process and to provide a soluble potassium salt.—A. B. S.

*Portland cement; Improving — by addition of finely ground granite or diorite.* E. Longan, Aylona, Spain. Ger. Pat. 293,121, Aug. 4, 1914.

FINELY ground granite or diorite which has been heated at about 1000° C. for at least two hours is added to the cement. Concrete of superior quality and resistant to sea water is obtained by using the improved cement as binding agent, with an aggregate composed of pieces of granite or diorite of the same kind as used for adding to the cement and which likewise have been heated at 1000° C.

—A. S.

*Heat-insulating material; Manufacture of —.* J. Oettershagen, Berlin. Ger. Pat. 293,221, July 1, 1914.

BLAST-FURNACE flue-dust, from which particles of iron have been removed, is mixed with suitable quantities of aluminum compounds and combustible material, moulded, dried, and baked at a moderate temperature in a kiln by means of waste fire-gases and excess of air. Dust and fragments produced in the process are mixed with clay and a binding agent and made into a mass which can be applied with a brush.—A. S.

*Plastic composition for flooring.* D. G. Anderson, Glasgow. U.S. Pat. 1,194,926, Aug. 15, 1916. Date of appl., Mar. 23, 1915.

SEE Eng. Pat. 21,987 of 1914; this J., 1915, 1146.

#### X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

*Vanadium; Electrometric titration of —.* G. L. Kelley and J. B. Conant. J. Amer. Chem. Soc., 1916, **38**, 341–351.

VANADIUM can be determined readily and accurately by titrating an acid solution containing the vanadium as vanadate with standardised ferrous sulphate solution, the end point being ascertained by a change in the E.M.F. of a suitable cell. The beaker containing the solution to be titrated and a platinum electrode is provided with a stirrer, and the solution communicates by way of a capillary tube with the potassium nitrate solution used to fill a wide-mouth bottle containing a calomel electrode. The changes of potential are detected by means of an ordinary suspension galvanometer. A double knife switch permits both the galvanometer and the main circuit to be put into action in one operation, and a resistance box containing two coils and sliding contacts with resistances of 195 and 5 ohms is so wired that one resistance serves to vary the E.M.F. of a battery of dry cells and the other serves as a potentiometer. During the addition of the ferrous chloride solution the resistance is varied so that the galvanometer needle is kept on the scale. After addition of about three-quarters of the total quantity of ferrous sulphate the needle remains practically at rest until the end point is reached, after which a sudden movement occurs; dilute standard bichromate solution is then added to restore the needle to its former position, and these alternate additions of ferrous sulphate and potassium bichromate may be repeated to ascertain the exact end point. The temperature should be low,

preferably 10° C., and the acid concentration at least 30 c.c. of sulphuric acid of sp.gr. 1·4 per 250 c.c. of solution. For oxidising the vanadium to vanadate, satisfactory results were obtained with potassium permanganate and with ammonium persulphate in presence of silver nitrate. The method may be used to determine vanadium in ferro-vanadium and with certain modifications to the analysis of ores. 1 gm. of the alloy is dissolved in dilute sulphuric acid (10 c.c. of acid of sp.gr. 1·4 to 100 c.c. or less of water), a small quantity of nitric acid is added to oxidise the iron and decompose carbides, and then the vanadium is oxidised to vanadate and determined as described.—A. S.

*Chromium and vanadium in steel; Determination of — by electrometric titration.* G. L. Kelley and J. B. Conant. *J. Ind. Eng. Chem.*, 1916, 8, 719—723.

Chromium in steel may be determined by the same method as vanadium (see preceding abstract), oxidation to chromate being effected by means of ammonium persulphate in presence of silver nitrate. To determine both chromium and vanadium, 2—3 grms. of the steel is dissolved in 60—100 c.c. of sulphuric acid of sp.gr. 1·2, the solution evaporated till salts separate, diluted to 60 c.c., oxidised whilst still hot with dilute nitric acid, again evaporated till salts separate, diluted to 200 c.c., heated to 80° C., treated with 5 grms. of sodium phosphate to retain tungstic oxide in solution (Wdowiszewski, *this J.*, 1911, 89), and the vanadium oxidised by titration with permanganate until the first "gray" colour appears. The solution is then cooled to 10—20° C., more sulphuric acid added, and the vanadium determined (*loc. cit.*). When the titration is finished, the solution is diluted to 300 c.c., heated to boiling, treated with 10 c.c. of a solution containing 2·6 grms. of silver nitrate per litre and 25 c.c. of a solution containing 200 grms. of ammonium persulphate per litre, boiled vigorously for 10 mins., and again for 5 mins. after adding 5 c.c. of hydrochloric acid (1:1). After cooling and adding a little more sulphuric acid, the chromium and vanadium are determined together by electrometric titration, and the amount of chromium calculated by difference.—A. S.

*Copper in low-grade ores [and slags]: Determination of —.* F. O. Hawley. *Eng. and Min. J.*, 1916, 102, 307—308.

To 1 gm. of slag, mixed with a little water in a beaker, 5 c.c. of a mixture of sulphuric and nitric acids and water in equal parts is added, followed by 20—25 drops of hydrofluoric acid. After boiling the mixture to expel the nitrous fumes and most of the silicon fluoride, another 10 c.c. of the acid mixture is added, the heating continued for a few minutes, and the solution cooled and diluted with about 70 c.c. of water. The solution is then neutralised with ammonia, of which an excess of 10 c.c. is added, and heated to 60°—65° C., when potassium cyanide solution is slowly added until the liquid is nearly decolorised; at least 75% of the copper should be thus combined with cyanide, but an excess of the latter is not desirable. The unfiltered, alkaline solution is then electrolysed, between a cathode and rotating anodes of platinum, by a current of 0·25 amp. for about 10 mins. followed by 0·5 amp. for 40 mins., after which the current is stopped, the beaker of liquid removed and replaced by one containing water in which the electrodes are quickly rinsed. The electrodes are then immersed in a similar volume of slightly warm water containing 7 c.c. of the nitric and sulphuric acid mixture, and the current reversed to dissolve the deposited copper, which requires only about 1 min. The current is then reversed again and the copper re-deposited at 0·6—1·0 amp.,

this second precipitation requiring 30—40 mins. Finally, the cathodes are removed, rinsed with water and alcohol in succession, and dried and weighed as usual. Copper ore is decomposed by means of nitric acid and potassium chlorate, with hydrochloric acid also, if necessary, after which 8 c.c. of sulphuric acid is added and the liquid evaporated until fumes of sulphur trioxide appear; 3 c.c. of nitric acid and 100 c.c. of water are then added, followed by ammonia and potassium cyanide as stated. 1 gm. of 8% ore requires about 90 and 45 mins. for the complete precipitation of copper from the alkaline and acid solutions respectively. The precipitation of the copper as brass from the alkaline solution is advantageous, the deposit being more dense and smooth than that of copper alone. For this purpose, zinc may be added to the alkaline liquid with the potassium cyanide, a good proportion being 1 part of ZnO to 6 of KCN; whether added or originally present in the ore, zinc is of course not finally deposited with the copper in acid solution. The method is rapid and accurate. The presence in the ore and slag of the added impurities, antimony, arsenic, bismuth, molybdenum, selenium and tellurium, did not affect the results, all of which were in close agreement with those obtained on the pure ore and slag by the above and the iodide and permanganate methods. Under the conditions of assay, the platinum electrodes lost weight at the rate of 0·0001 gm. per 1 to 6 determinations, this being very slightly greater than in ordinary acid electrolysis.—W. E. F. P.

*Brass; Electrolytic deposition of —.* A. Höning. *Z. Elektrochem.*, 1916, 22, 286—293.

The separation potentials of copper and zinc from complex cyanide solutions were determined for current densities up to 0·01 amp. per sq.cm., and the influence of various additions to the bath, as also the influence of varying concentrations of the CN and OH ions, on the appearance of electrolytically deposited brass, determined. The experiments showed that for the deposition of brass the cathode potential must closely approach that necessary for the deposition of zinc from cyanide solutions. Whilst in potassium-copper cyanide solutions which contain at least 2KCN to 1CuCN, and therefore presumably contain the salt  $K_2Cu(CN)_4$ , the cathodic copper separation is accompanied by considerable polarisation, it becomes, at least with small current densities, almost reversible in solutions of the salt  $KCu(CN)_2$ . If increasing quantities of KCN are added to the latter solutions, the polarisation increases largely, long before all the  $CuCN$  can be present as  $K_2Cu(CN)_4$ . Also the presence of  $K_2Zn(CN)_4$  in  $Cu(CN)_2$  solutions causes strong polarisation of the copper separation, whereby there is brought about just as in the solution of  $K_2Cu(CN)_4$  and  $K_2Zn(CN)_4$ , a rise in the separation potential of the copper nearly up to that of the zinc, and as a result, electrolysis of brass from the solution takes place. The separation potential of copper from cyanide solutions can be raised considerably by allowing the solutions to stand and by heating them. It is suggested that this result is due to changes in small quantities of colloidal material. If so, the polarisation of the cathode depends in these cases on continually renewed surface layers (mechanical passivity of the cathode).—T. ST.

*Nickel; Electrolytic deposition of — from chloride solutions. II. The exfoliation of the nickel.* R. Riedel. *Z. Elektrochem.*, 1916, 22, 281—286. (See also this J., 1915, 555.)

NICKEL deposited electrolytically at the ordinary temperature on smooth nickel sheet cathodes from an electrolyte of nickel chloride solution acidified with acetic acid, peels off after a founda-

tion only a fraction of a mm. thick has been deposited. Fine cracks soon appear at the edges and gradually extend over the whole surface forming a reticulated pattern. Additions such as glycerin, affecting the viscosity of the solution, and others such as amyl alcohol, affecting the surface tension, effected no improvement. Other additions such as pine-wood extract, colloids, etc., were also made without improving the deposit. It would appear that the first-deposited nickel undergoes a volume change a little while after deposition. This would result if a nickel-hydrogen alloy was first deposited and later gave off hydrogen (compare Foerster and Römmler, *Z. Elektrochem.*, 1907, 13, 567), or if an unstable form of nickel was first deposited, and later changed into the stable form. Oxidising agents and substances capable of forming additive compounds with hydrogen were, however, added to the electrolyte without success. Good, firmly-adhering deposits, on the other hand, were obtained with roughened cathodes. The roughening was produced mechanically with emery and by sand-blasting, and chemically by etching with different acids. A current density of 300 to 400 amps. per sq. m. gave the best deposits; 1000 amps. per sq. m. produced lumpy edges, but the deposit was firm and thick. Good deposits were also obtained from a cold nickel chloride solution by using cathodes on which thin firmly adhering deposits had been made by electrolysis either at a high temperature, or from a cold concentrated solution of equal parts of nickel sulphate and sodium ethylsulphate. It made no difference whether the original electrodes thus treated were rough or smooth, and in one case the preliminary treatment lasted only 5 minutes, giving a deposit only 0.003 mm. thick. The cathodes thus prepared became uncertain in their action if kept for more than a few days.—T. ST.

*Lead blast-furnaces; Flow of air in —.* A. W. Tournay-Hinde. Eng. Assoc., N.S.W. Eng. and Min. J., 1916, 102, 392—393.

EXPERIMENTS made at the Cockle Creek smelter, N.S.W., showed that with the same pressure in the blast-main the rate of smelting was lower with tuyères with conical apertures than with large-diameter tuyères. The air-pressure in the smelting-zone is dependent on the tightness of the charge; the variation in size of the tuyère opening only varies the amount of energy required to force a given volume of air into the furnace.

—W. R. S.

*Silver; Injurious action of oxygen on fine —.* G. J. Roman. Metall u. Erz, 1916, 13, 221—225. Z. angew. Chem., 1916, 29, Ref., 377.

FINE silver permeated by microscopic bubbles containing oxygen will not give satisfactory castings even after repeated re-melting. Treatment with the usual deoxidising agents, subjecting to a vacuum, and melting in an atmosphere of inert gas fail to overcome the difficulty. Satisfactory castings can be obtained after addition of copper, but the alloy produced is unsuitable for many purposes in the fine metal and electrochemical industries. If crystals of electrolytically deposited silver be finely ground, traces of electrolyte may be removed by washing with hot water, and the purified silver when melted will give sound castings.—A. S.

*Tungsten; Determination of —, and its separation from tin.* E. Dittler and A. von Graffenreid. Chem.-Zeit., 1916, 40, 681—682.

THE criticism made against Fieber's method (this J., 1912, 389), that the pulverisation of the analytical sample takes an inordinate amount of

time, is held to be unfounded; and this method is recommended strongly not only for ferro-tungsten but also for the determination of tungsten in materials containing tin, arsenic, copper, and molybdenum, provided that the following precautions are observed. The sample for analysis should weigh about 0.2 grm., be ground in a steel mortar, and sifted through the finest gauze. The treatment with bromine should last 24 hours, and water should be rigorously excluded. A second treatment with bromine is seldom necessary. After the sample has been dissolved (with the exception of silica), about 10 c.c. of hydrochloric acid is added, the liquid is evaporated nearly to dryness, and then a few c.c. of concentrated nitric acid and 2—3 c.c. of hydrochloric acid are added. The liquid containing the canary-yellow, crystalline precipitate of tungsten trioxide is left for 2 hours, the precipitate washed by decantation until no iron can be detected in the wash water, filtered off, and ignited at a moderate temperature. The results are accurate to 0.1%. Concentrates rich in tungsten and containing not more than 10% of tin as stannic oxide, are treated similarly, but the tungsten oxide must be separated from admixed stannic oxide by ignition with ammonium chloride. Tin ores containing tungsten are best disintegrated by fusion with sodium peroxide, and the metal determined by the mercurous nitrate method, the precipitation being performed in a neutral solution; the ignition should be done in a porcelain vessel if antimony be present. The results may be somewhat high. A new method of estimating tin in ores which also contain tungsten consists in melting a 1 grm. sample with 6—8 grms. of sodium peroxide in an iron crucible over the full flame of a Teclu burner. The cooled melt is treated with water and the solution made up to 500 c.c., of which 250 c.c. is used for the tungsten determination by the mercury method, and 200 c.c. for the estimation of tin. To the latter end, the solution is treated with a concentrated aqueous solution of 10 grms. of commercial sodium phosphate and acidified, any precipitate (e.g., silica or hydrated manganese peroxide) is filtered off, the liquid is boiled to decompose remaining peroxide, and is then saturated hot with hydrogen sulphide, subsequently diluted with water, and again saturated. After standing, the precipitate is washed with ammonium acetate solution until no more free acid is present, then dried, and the tin determined as oxide or electrolytically. The tungsten is removed in the washing as soluble phosphotungstic acid.—E. H. T.

*Radium production in Bohemia.* U.S. Comm. Rept., Aug. 17, 1916.

THE Bohemian uranium ore mines produced, in 1915, 25,720 lb. of uraninite prepared for smelting, having an average value of 19s. per lb. The Government mine at Joachimsthal produced 2325 lb. of uranium compounds, valued at about £1200. The Government radium factory produced compounds containing 1.75 grms. of radium elements, valued at £40,000.

[*Ore*] flotation; *Wood oils suitable for —.* R. C. Palmer, G. L. Allen, and O. C. Ralston. U.S. Bureau of Mines. Amer. Inst. Min. Eng., Sept., 1916. Eng. and Min. J., 1916, 102, 311—313.

THE results are given of preliminary tests in which commercial wood oil and other products from the distillation of hardwood were employed with typical sulphide ores in acid, alkaline, and neutral solutions. Many of the wood products were found to be as efficient as pine oil in their behaviour towards the minerals tested; and good all-round results were obtained with the crude hardwood tar settled out of pyrolygneous acid.

The results are regarded as decidedly encouraging, especially in view of the fact that the products in question are practically waste and immediately available at low prices.—W. E. F. P.

*Practical methods for testing refractory firebricks.*  
Nesbitt and Bell. *See VIII.*

*Aluminium [electrical] machines.* Richter. *See XI.*

PATENTS.

*Iron, steel, and other substances not easily reduced to the molten condition; Melting of —.* F. G. C. Rincker, The Hague, Holland. Eng. Pat. 14,215, Oct. 7, 1915. Under Int. Conv., June 3, 1915.

AN open-hearth furnace is heated on the regenerative system by the combustion of gasified oil. A liquid hydrocarbon is sprayed directly, without admixture with steam, into the upper part of a gas-producing chamber, previously heated by the waste gases from the furnace. The gases formed are led from the lower part of the chamber into a similarly formed superheater chamber, from which they pass to the hearth, where they are burnt with air heated by passage through similar chambers. Any carbon, tar, or the like, remaining in the gas generators and superheaters after the gas formation, are burnt with the aid of fresh air.

—T. ST.

*Steel and high-phosphorus slag; Method of producing —.* A. W. Allen and E. G. Lilly, Birmingham, Ala. U.S. Pat. 1,193,496, Aug. 8, 1916. Date of appl., June 18, 1915.

After removing the silicon from pig iron and separating the resulting slag, sufficient lime and iron oxide are added to form a slag in which the bulk of the phosphorus is removed. Part of the metal and slag are withdrawn and replaced by fresh quantities of pig iron and fluxes. The metal is separated from the high-phosphorus slag, and the last of the phosphorus removed by treatment with a slag containing excess of lime.—W.R.S.

*Iron of high grade from ordinary cast-iron; Process of producing —.* J. A. Leonard, New York, and J. P. Larimer, Brooklyn, N.Y. U.S. Pat. 1,194,756, Aug. 15, 1916. Date of appl., Apr. 6, 1912.

CAST-IRON is "baked," in a closed holder, in the presence of hydrated oxide of iron and silica (with or without phosphorus), to render the metal capable of being acted on by carbon; and then quenched in a bath containing carbon with or without calcium sulphate and ferric oxide.

—W. E. F. P.

*Ferromanganese; Preventing incrustations in metallurgical melting and transporting apparatus for easily oxidisable metals and alloys, especially —.* Ges. f. Elektrostahlalnen, Siemensstadt, and W. Rodenhauser, Völklingen. Ger. Pat. 293,043, June 25, 1913.

The parts of the furnace which come in contact with the molten metal are covered with a layer of powdered carbonaceous material, *e.g.*, coke dust, and coke dust is also placed in the ladle so that on running in the molten metal it is forced outwards to the walls to form a protective layer.—A. S.

*[Copper] ore; Concentration of —.* A. C. Howard, L. A. Wood, and Minerals Separation, Ltd., London. Eng. Pat. 8263, June 3, 1915.

COPPER sulphide ores are powdered and subjected to flotation separation, with aeration, in an aqueous medium containing a mineral-frothing agent, such as creosote oil from blast-furnace tar, and a caustic alkali such as sodium hydroxide. The caustic alkali, in the amount of about 1 lb. per ton of ore, is added immediately before the frothing operation,

—T. ST.

*Zinc from ores and other zinc bearing materials; Electrolytic recovery of —. Electrolytic recovery of metals from their solutions, and apparatus therefor.* U. C. Tainton, Johannesburg, Transvaal. Eng. Pats. (A) 11,335, and (B) 11,336, Aug. 5, 1915.

(A) A CONTINUOUS or cyclic process is used for the electrolytic extraction of metallic zinc from ores, sufficient of the latter being added to an acid to form a concentrated solution of a zinc salt, and the neutral solution separated from the residue. An excess of acid (50 to 300 grms. per litre) is added, and the solution is electrolysed, using a current of high density (50 to 1000 ampères per sq. ft.) The solution, now strongly acid, is divided into two parts, one portion being neutralised by a further addition of ore, and then mixed with the second portion so as to give approximately the same acid content as above, and the process is repeated. (B) A series of anodes, alternating with cathodes, are separated by distance frames with porous diaphragms between the adjacent electrodes, the latter being connected in parallel. Means are provided for the escape of evolved oxygen from the anode compartments. Each cathode element is provided with a porous support, upon which a coating, covering, or cake, of finely divided conducting material, such as graphite, is deposited from a solution carrying the material in suspension, or the graphite may be introduced with the solution to be treated. During the electrolysis, the metal-bearing solution is passed through the porous support and the graphite, upon which the metal is deposited. The coating with the precipitated metal is removed, and screened so as to concentrate the portion of the detached material carrying the metal—B. N.

*Zinc; Recovery of —.* C. H. Fulton, Cleveland, Ohio, Assignor to D. B. Jones, Chicago, Ill. U.S. Pat. 1,193,080, Aug. 8, 1916. Date of appl., Dec. 23, 1915.

THE ore is ground, calcined, mixed with powdered coke and 12–15% of pitch or tar, and pressed into moulds; the briquettes are heated so as to coke the binding material without reducing the zinc oxide, and then subjected to distillation. The weight of added coke powder is such that the weight of the briquettes after distillation will not be less than 40–50% of their original weight.

—W. R. S.

*Separating metals; Process of —.* A. H. Sherwood, Oroville, Cal. U.S. Pat. 1,192,945, Aug. 1, 1916. Date of appl., Sept. 24, 1913.

THE material is treated with nitric acid to remove base metals and silver, and the residue of gold and platinum metals amalgamated in presence of a solution of cobalt nitrate. The resulting gold amalgam is parted with nitric acid.—W. R. S.

*Gold; Method of extracting —.* A. W. Smith, Cleveland, Ohio. U.S. Pat. 1,193,197, Aug. 1, 1916. Date of appl., Aug. 15, 1911.

THE ore is ground with a solution of cyanide and an oxyhalogen compound such as a bromate, enough lime being added to maintain an alkaline reaction. The mixture is then agitated with air.

—W. R. S.

*[Electric arc furnace] for reducing ores and fusing other materials.* C. B. Hillhouse, New York. U.S. Pat. 1,193,783, Aug. 8, 1916. Date of appl., Nov. 25, 1912.

THE finely divided ore, etc., is blown under pressure axially into an electric arc furnace with a vertical axis, the material falling upon a surface heated by the arc.—W. R. S.

**Aluminim : Composition for welding and soldering articles of —.** R. L. Weatherford, Fort Worth, Tex. U.S. Pat. 1,194,101, Aug. 8, 1916. Date of appl., May 22, 1916.

A COMPOSITION for welding and soldering aluminium articles, consists of aluminium 1, lead 1, block tin 2, zinc 2, commercial bismuth 1, and antimony 1 part.—W. R. S.

**Soldering compound.** F. E. J. Litot, Wilkinsburg, Pa. U.S. Pat. 1,194,438, Aug. 15, 1916. Date of appl., Mar. 22, 1915.

THE solder, composed mainly of zinc, contains (a) not more than 1% of phosphorus, (b) not more than 5% of phosphor-tin, or (c) not more than 2% of phosphor-tin.—W. E. F. P.

**Metals [cadmium, etc.] ; Process for separating —.**

R. H. Stevens, Salt Lake City, Utah, Assignor to United States Smelting, Refining and Mining Co., Portland, Me. U.S. Pat. 1,194,438, Aug. 15, 1910. Date of appl., Nov. 20, 1912.

ROASTED ore containing cadmium, bismuth, copper, lead, tellurium, arsenic, etc., is treated with sulphuric acid and the solution electrolysed, first at low voltage to separate bismuth and copper, and then at higher voltage to obtain a deposit rich in cadmium. After being fluxed with sodium hydroxide and carbon to separate tellurium, the cadmium deposit is cast into ingots and treated by electrolysis to obtain pure cadmium (cathode) and a cadmium-containing residue (anode). The latter is then melted and cast into ingots which are subsequently re-electrolysed in a cadmium electrolyte to obtain pure cadmium and an anodic residue rich in bismuth.—W. E. F. P.

**Radium [carnotite] ore ; Concentrating —.** H. Schlundt, Columbia, Mo. U.S. Pat. 1,194,069, Aug. 15, 1916. Date of appl., Feb. 21, 1916.

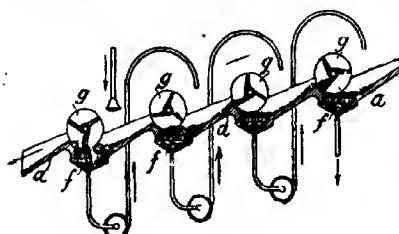
THE ore is treated with hot sulphuric acid, of about 60° B. (sp.gr. 1.71) or stronger, to dissolve radium and barium, and the mixture diluted. The precipitated radium-barium sulphate is separated from the undissolved residue by differential sedimentation.—W. E. F. P.

**Metals ; Magnetic treatment of —.** F. L. Bishop, Pittsburgh, Pa. U.S. Pat. 1,194,940, Aug. 15, 1916. Date of appl., Jan. 2, 1914.

IN a process for altering the molecular structure of a metal, the latter is subjected to the action of a magnetic field produced by an alternating current, and thus heated above its recalcitrance point, the current being controlled automatically by the changes in the magnetic properties of the metal during treatment.—W. E. F. P.

**Ores, minerals, and other materials ; Apparatus for the continuous lixiviation of —.** H. B. de Florin, Aussig. Ger. Pat. 293,171, Aug. 12, 1915.

THE ore travels downwards over an inclined trough



or the like, and the lixiviating liquid travels, as a

whole, in the opposite direction, but over separate portions of the path flows backwards in the same direction as the ore. Various forms of apparatus may be used. For example, the ore may pass downwards through a series of inclined troughs, *a*, being delivered from one trough to the next by the shafts, *g*, with arms of acid-proof material. The solution flows from each trough through a filter, *f*, and is pumped up into the next higher trough.—A. S.

**Platinum and allied metals ; Recovery of — from low-grade platinum ores.** B. Streit, Düsseldorf. Ger. Pat. 293,104, Mar. 26, 1914.

THE finely powdered ore is mixed with magnesium chloride and sodium nitrate, or agglomerated with a solution of the salts, and heated to about 330° C., after which it is treated as usual for the recovery of the platinum.—A. S.

**Hydraulic concentrator or classifier.** F. F. Wagner, Denver, Colo. U.S. Pat. 1,193,953, Aug. 8, 1916. Date of appl., June 29, 1915.

**Coatings for iron and steel metallic articles.** C. Mark, Evanston, Ill., U.S.A. Eng. Pat. 11,557, Aug. 10, 1915. SEE U.S. Pat. 1,186,217 of 1916; this J., 1916, 849.

**Metallic coatings ; Method of applying — to metallic articles.** C. Mark, Evanston, Ill., U.S.A. Eng. Pat. 101,128, Aug. 10, 1915. (Appl. No. 5518 of 1916.)

SEE U.S. Pat. 1,168,664 of 1916; this J., 1916, 313.

**Nickel ; Recovery of — from its ores.** H. L. Sulman and H. F. K. Picard, Assignors to The Madagascar Minerals Synd., Ltd., London. U.S. Pat. 1,193,734, Aug. 8, 1916. Date of appl., Feb. 18, 1914.

SEE Eng. Pats. 17,131 and 18,769 of 1913; this J., 1914, 489.

**Sintering metal ; Method and apparatus for —.** R. B. Walling, Newark, N.J., Assignor to General Electric Co. U.S. Pat. 1,194,906, Aug. 15, 1916. Date of appl., Oct. 7, 1912.

SEE Eng. Pat. 14,795 of 1913; this J., 1914, 425.

**Dry process and apparatus for purifying blast furnace gases.** Eng. Pat. 17,081. See II A.

## XI.—ELECTRO-CHEMISTRY.

**Aluminium [electrical] machines.** R. Richter, Z. Elektrochem., 1916, 22, 294—296.

THE use of aluminium, iron, and zinc for conductors has become general in Germany during the war. The layer of oxide which quickly forms on aluminium wire is sufficient insulation for field-magnet windings, for low voltages, and thus allows of space being economised. Aluminium, however, cannot be used for commutators. For rotating machines of average size the efficiency with aluminium windings is 0.5 to 2, with zinc 3 to 6, and with iron 8 to 12% less than with copper. The relative costs of a normal alternating current motor (62 K.W., 750 revs. per min., 50 cycles per sec.) at pre-war metal prices are given as follows:—copper 100.0, aluminium 96.8, zinc 150.7, iron 161.8. The prospects for iron and zinc machines, after the war, are unfavourable, but it is expected that aluminium will be used in preference to copper in many cases for the windings of electrical machines.

—T. St.

## PATENTS.

*Insulating compositions; Electric* —. E. Søhrg and J. Andersen, Lillehammer, Norway. Eng. Pat. 101,067, Apr. 12, 1916. (Appl. No. 5398 of 1916.)

POLYMERISED magnesium silicate, such as Norwegian talc-potstone (50%) is mixed with 40% of resin and 10% of linseed oil as a binder. The oil is thickened by boiling, the resin added, and the mixture well boiled, the powdered potstone being finally stirred in. An alternative composition is composed of 80% of talc-potstone powder, 20% of shellac, and a small quantity of spirit.—B. N.

*Anodes; Preventing disintegration of* —. G. D. van Arsdale, New York. U.S. Pat. 1,193,741, Aug. 8, 1916. Date of appl., Aug. 2, 1915.

GRAPHITE anodes, in the electrolysis of copper solutions, are prevented from disintegrating, by electrolyzing in the presence at the anode of ferrous sulphate and sulphur dioxide, in amounts sufficient to prevent the evolution of free oxygen.

—B. N.

*Furnace; Electric arc* —. E. Edwin, Assignor to Norsk Hydro-Elektrisk Kvaelfstofaktieselskab, Christiania, Norway. U.S. Pat. 1,193,882, Aug. 8, 1916. Date of appl., May 13, 1915.

SEVERAL electric arc furnaces are combined, each furnace consisting of a tube forming the reaction chamber, with an electrode insulated from the tube at one end, and a second electrode electrically connected to the tube at the other end. A gas inlet is provided near the insulated electrode, and an outlet near the other end. A polyphase current is employed, with an electrical star connection between the insulated electrodes belonging to a group of furnaces and the corresponding phase of the source of electricity; groups of furnaces are connected in parallel with the source of electricity, and an electrical connection insulated from earth is employed between the other electrodes.—B. N.

*Electrolytic apparatus for production of liquor for bleaching and other purposes*. A. Holliday, London. U.S. Pat. 1,193,750, Aug. 8, 1916. Date of appl., Dec. 22, 1915.

SEE Eng. Pat. 1672 of 1915; this J., 1915, 622.

*Electrolytic method of purifying sewage*. U.S. Pat. 1,194,000. See XIXB.

*Electrolytic and saponifying process for producing oxamide*. U.S. Pat. 1,194,354. See XX

## XII.—FATS; OILS; WAXES.

*Fats; Determination of the melting-point of* —. M. Monhaupt. Chem. Zeit., 1916, 40, 676.

The initial melting point of fats is determined by introducing a quantity of the sample sufficient to form a column about 3 to 8 mm. deep, into a capillary tube of 1 to 1.5 mm. diameter, and sealing up one end of the tube. After the fat has solidified, it is melted again at a moderate temperature, and the tube is then allowed to stand on ice. A pointed piece of wire or a needle 25 to 30 mm. in length is placed in the tube so that its point rests on the solidified fat, and the tube attached to a thermometer, which is immersed in a beaker of water. The temperature at which the point penetrates the fat gives the m.p. Occasional shaking of the tube is necessary to prevent adherence of the needle to the side.—C. A. M.

*Beeswax; Hydrocarbons of* —. H. Ryan and T. Dillon. Scient. Proc. Roy. Dublin Soc., 1916, 15, 107—112.

DIRECT experiments with melissyl alcohol have shown that in Buisine's method of measuring the hydrogen evolved on heating the wax with potash and potash-lime at 250° C. (this J., 1891, 52), 95.9% of the theoretical quantity of hydrogen is obtained. Synthetic higher tertiary and secondary alcohols do not evolve any hydrogen in the test, so that if esters of such alcohols are present in beeswax the volume of hydrogen evolved would be less than that calculated from the ester value. It is possible that about 1.3% of the combined alcohols in beeswax may consist of tertiary or secondary alcohols. The so-called hydrocarbons extracted by petroleum spirit from the product of the interaction of the wax with potash-lime contain on the average about 0.8% of oxygen, and it is suggested that alcohols other than primary alcohols may be present.—C. A. M.

*Soap making and glycerol recovery; The Krebitz process of* —. G. A. Wrisley. J. Ind. Eng. Chem., 1916, 8, 732—733.

THE Krebitz process (see Eng. Pats. 4002 and 4092A of 1905 and U.S. Pat. 1,126,787 of 1915; this J., 1906, 188, 434; 1915, 290) has been worked on the large scale with good results at Chicago. From 1200 to 1400 lb. of lime is slaked with 3700—4500 lb. of water, the mass is heated, if necessary, to 70° C., 19,000 lb. of fat and oil is run in with vigorous agitation, and the mixture is heated with live steam to 90°—92° C. in the course of half an hour. The vessel is covered and after 8—12 hours, the soap is discharged through a trap-door in the bottom, and ground to the size of fine corn meal. The ground soap is washed four times with water in a hopper-shaped tower of 25,000—30,000 lb. capacity, using altogether about 40,000 lb. of water; the first wash-water contains 10—12% of glycerol and is treated for the recovery of glycerol, and the later wash waters are used again; about 95% of the total quantity of glycerol is recovered. After being washed the calcium soap is introduced slowly into a soap kettle containing a boiling solution of sodium carbonate, and when decomposition is practically complete a small amount of caustic soda is added, after which the soap is salted out. The lime sludge which settles to the bottom carries down 9—12% of soap; it is heated and vigorously agitated with sufficient water to dissolve the soap; after settling and removing the soap solution, the lime sludge can be filter-pressed, and only 1—1.5% of soap is lost in the press-cake. The soap compares favourably in quality with that made by the usual process; it contains always at least 0.2%, and sometimes 0.5—0.7% of lime.—A. S.

*Soap powders; Analysis of* —. L. Rosenberg and V. Lenher. J. Ind. Eng. Chem., 1916, 8, 716—718.

Two granules of the powder is dried in a vacuum oven at 65° C. until of constant weight to determine the moisture. The residue is extracted with light petroleum spirit, the solution evaporated, and the residue of free fatty matter dried at 110° C. and weighed. The residue insoluble in petroleum spirit is extracted with 95% alcohol which dissolves soap and free alkali; the latter is determined by titration with N/10 acid, using phenolphthalein as indicator, and the solution then diluted, boiled to expel alcohol, the soap decomposed with excess of N/1 nitric acid, and the fatty acids separated as a cake with the aid of 4 grms. of stearic acid previously heated to 160° C.; by titrating the excess of acid the quantity of alkali combined as soap is obtained. The residue insoluble in alcohol is dissolved in hot water, the solution diluted to

250 c.c., and divided into five portions for the determination of sodium carbonate by titration with acid, sodium chloride by precipitation with silver nitrate, sodium silicate as silica, sodium sulphate by precipitation with barium chloride, and borax by the glycerol or mannitol method. In seven commercial soap powders examined, the following results were obtained: moisture, 18.52—43.38%; fatty anhydride, 16.74—21.63;  $\text{Na}_2\text{O}$  as soap, 2.23—3.58; total soap, 18.97—24.34;  $\text{Na}_2\text{CO}_3$ , 36.30—56.45;  $\text{Na}_2\text{Si}_4\text{O}_8$ , 0.36—0.99;  $\text{NaCl}$ , 0.31—1.32; unsaponified matter, 0.24—0.87%.—A. S.

*Soap solutions; Studies on* —. V. Lenher and M. V. R. Buell. *J. Ind. Eng. Chem.*, 1916, 8, 701—703.

EXPERIMENTS were made with the Traube stalagmometer (compare Shorter, this *J.*, 1916, 549) on the surface tension of sodium oleate solutions towards air, oil of turpentine, kerosene, benzene, toluene, and cottonseed oil. Towards air the surface tension increased as the concentration of the solution fell from *N*/1 to about *N*/100. In the other cases the surface tension was lower with the concentrated than with the dilute solutions, and the general direction of the curves was the same. In comparative tests the quantity of sodium oleate required to produce stable emulsions at 20° C. with 50 c.c. of water and 50 c.c. of various other substances was as follows:—oil of turpentine, 0.03 grm.; carbon tetrachloride, 0.114 grm.; chloroform, 0.78 grm.; benzene, 0.98 grm.; vaseline (2.5 grms.), 1.52 grms. Other experiments showed that a definite quantity of sodium oleate will emulsify more chloroform or olive oil at a high than at a low temperature, and that weaker solutions of sodium oleate are relatively more effective than more concentrated solutions in emulsifying oil of turpentine. The emulsifying power of sodium oleate solution is impaired only very slightly by the hydrolysis which occurs on keeping. At 100° C. sodium palmitate is more effective than sodium oleate or stearate in emulsifying olive oil.—A. S.

#### PATENTS.

*Wool-grease; Method of refining* —. J. O. Handy and R. M. Isham, Assignors to Pittsburgh Testing Laboratory, Pittsburgh, Pa. U.S. Pat. (A) 1,194,013 and (B) 1,194,014, Aug. 8, 1916. Date of appl., Apr. 22, 1916.

(A) THE grease is dissolved at the ordinary temperature and pressure in petroleum spirit or other neutral inert solvent, and the solution is treated with ammonia or ammoniacal alcohol. (B) The grease is treated with alcohol to remove part of the free fatty acids, and the neutralisation is completed by dissolving the residue in petroleum spirit and shaking the solution with dry magnesium oxide or other basic oxide or hydroxide to which fullers' earth may be added as a bleaching agent.—C. A. M.

*Wool grease; Method of treating [bleaching]* —. J. O. Handy, Assignor to Pittsburgh Testing Laboratory, Pittsburgh, Pa. U.S. Pat. 1,194,015, Aug. 8, 1916. Date of appl., Apr. 22, 1916.

THE grease is dissolved in petroleum spirit or other solvent, the solution shaken with fullers' earth, and the solvent distilled and recovered.—C. A. M.

*Palm and other nuts; Treatment of* —. P. C. Ruschen, London. From F. Krupp A.-G. Grusonwerk, Magdeburg-Buckau, Germany. Eng. Pat. 11,686, Aug. 12, 1915.

*Process for reducing matter [garbage, etc.] containing grease or oil.* U.S. Pat. 1,193,743. See XIIB.

#### XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

*Chrome yellow. I. The system*  $\text{PbSO}_4 + \text{K}_2\text{CrO}_4 \rightleftharpoons \text{PbCrO}_4 + \text{K}_2\text{SO}_4$ . J. Milbauer and K. Kohn. *Z. physik. Chem.*, 1916, 91, 410—430. *J. Chem. Soc.*, 1916, 110, ii, 441.

WITH the object of explaining the formation and nature of the variously tinted forms of chrome yellow prepared on the large scale, the authors have investigated the reaction

$\text{PbSO}_4 + \text{K}_2\text{CrO}_4 \rightleftharpoons \text{PbCrO}_4 + \text{K}_2\text{SO}_4$  from the point of view of the phase rule and of chemical equilibrium. It is shown that the reaction proceeds practically completely in the direction from left to right, and at such a rate that it can be readily followed. The velocity in the opposite direction is very small, and can only be detected by the great sensitiveness of the reaction,  $\text{CrO}_4^{2-} + 8\text{H}^+ + 6\text{I}^- = \text{Cr}^{3+} + 4\text{H}_2\text{O} + 3\text{I}_2$ . From determinations of the stability, it is shown that the solid phase  $\text{PbSO}_4$  cannot exist in the presence of  $\text{K}_2\text{CrO}_4$ ,  $\text{K}_2\text{SO}_4$ , and  $\text{PbCrO}_4$ , and, further, the existence of double salts is unlikely. The determination of the mass-action curve was rendered very difficult owing to the very small equilibrium constant and the strong adsorption. Adsorption is very marked at lower temperatures and high concentration, and is doubtless of importance in the manufacture of particular shades of chrome-yellow. The equilibrium constant is so small that it follows that the region of existence of lead sulphate practically vanishes from the isothermal diagram. The velocity of the reaction increases with increasing temperature, but here also the adsorption causes the velocity coefficients to appear as functions of the adsorption. It follows as a general result that the manufacture of chrome yellow can be carried out from lead sulphate, and that various shades can be obtained by varying the conditions, temperature, concentration, and time. It also follows that in the manufacture an excess of lead acetate should be used, for this will secure the absence of potassium chromate in the product. This point is essential, since such chromate would rapidly convert the lead sulphate, which is necessary for the particular shade, into lead chromate, and so the shade would be changed. The theory which explains the stability of chrome-yellow by the existence of a lead sulphochromate is unlikely, since the present experiments make the existence of these double salts extremely doubtful.

*Manganese in pigments, varnishes, etc.; Colorimetric method for the detection of* —. J. F. Sacher. *Farbenzeit.*, 1915, 20, 1309. *J. Chem. Soc.*, 1916, 110, ii, 451.

THE reaction between manganese hydroxide and oxalic acid described previously by the author (this *J.*, 1915, 638) may be used for the detection of manganese in pigments, paints, varnishes, etc. A small quantity of the substance is incinerated, the ash dissolved in water, and the solution filtered; the filtrate is rendered very slightly alkaline, heated gently, then cooled, and 3% oxalic acid is added drop by drop. A red coloration is obtained when just sufficient of the oxalic acid has been added to dissolve the manganese hydroxide. The test will detect as little as 0.03 mgm. of manganese in 0.1 grm. of substance.

*Rosin; Extraction of* — from wood. *Experiments using a petroleum solvent.* R. C. Palmer and H. R. Boehmer. *J. Ind. Eng. Chem.*, 1916, 8, 695—701.

EXPERIMENTS were made with long-leaf pine

stumps in an extraction hattery of three retorts, each with a capacity of 30—35 lb. of wood. Gasoline boiling almost entirely between 70° and 150° C. was used as solvent. The wood was used in the form of chips averaging  $\frac{1}{4}$  in. and  $\frac{1}{2}$  in. respectively along the grain, and each lot received four washes, the arrangement being such that the fresh wood was treated with the nearly saturated solvent whilst the nearly spent material came in contact with fresh solvent. The results indicate that practically the whole of the petroleum-soluble resin in the wood can be extracted in this way from  $\frac{1}{4}$  in. chips by four washes of 15 min. each under 30 lb. pressure, the vaporised solvent being returned continuously to the retort during the extraction. Considerably less resin was extracted from the  $\frac{1}{2}$  in. chips. The spent  $\frac{1}{4}$  in. chips when treated by the sulphate process gave pulp from which a good grade of No. 2 Kraft paper was made. A rotary type of digester would probably prove best in commercial practice. It is estimated that a plant with a capacity of 200 tons of wood would yield a quantity of spent chips sufficient to furnish the fuel required and in addition raw material for a 20-ton pulp mill.

—A. S.

*Pine balsam.* F. Henrich. *Chem.-Zeit.*, 1916, 40, 673—674.

THE balsam (208 grms.) obtained in one day from a German pine (*Pinus sylvestris*), was distilled, first with ordinary and then with superheated steam, and yielded 24 to 25% of volatile constituents. The first fraction of 37 grms., when re-fractionated, yielded as its main constituent a liquid with b.p.t. 153° to 154.5° C., sp.gr. 0.8501 at 20°/4° C.; and  $[\alpha]_D^{20} = +20.90$ . The second fraction of 13 grms., when extracted with ether, dried, and redistilled, yielded fractions boiling at 155° to 157° C. and at 157° to 170° C., the latter having sp.gr. 0.8618 at 20°/4° C., and  $[\alpha]_D^{20} = +12.03$ . Pinene was identified both in the first and second fractions. The residue in the distillation flask melted at 90° to 115° C., and after extraction with 70% alcohol at 127° to 130° C. The final residue was identified as abietic acid.

—C. A. M.

#### PATENTS.

*Coatings for walls and other surfaces.* M. C. Church, Grand Rapids, Mich., U.S.A. Eng. Pats. (A) 8429, June 7, 1915, and (B) 100,162, June 7, 1915. (Appl. No. 3735 of 1916.) Under Int. Conv., June 19, 1914.

(A) FINELY pulverised uncalcined gypsum is mixed with glue, with or without the addition of whiting or other inert powder. Water is added to the mixture before use; or the preparation may be made into paste, which is subsequently diluted. (Reference is directed, in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pat. 13,154 of 1895.) (B) The coating given with a mixture such as is described in (A) is treated with a solution of alum, which hardens the surface and renders it durable and suitable for painting and varnishing.—C. A. M.

*Resinous products and method of producing same.* J. P. A. McCoy, Wilkinsburg, Pa., Assignor to Westinghouse Electric and Manufacturing Co. U.S. Pat. 1,194,201, Aug. 8, 1916. Date of appl., June 14, 1912.

THE product of the interaction of an oil or oily substance with sulphur chloride is mixed with phenol and treated with formaldehyde.—C. A. M.

#### XIV.—INDIA-RUBBER; GUTTA-PERCHA.

##### PATENT.

*Caoutchouc: Manufacture of synthetic* —. A. Heinemann, London. U.S. Pat. 1,194,839, Aug. 15, 1916. Date of appl., Aug. 9, 1913. SEE Eng. Pat. 18,506 of 1912; this J., 1913, 1022.

#### XV.—LEATHER; BONE; HORN; GLUE.

##### PATENT.

*Tanning of hides and skins.* E. W. Merry, Sheffield. Eng. Pat. 17,350, Dec. 10, 1915. SEE U.S. Pat. 1,191,527 of 1916; this J., 1916, 935.

#### XVI.—SOILS; FERTILISERS.

*Calcium oxide in peat soils; Rapid method for determining* —. R. A. Gortner. *Soil Sci.*, 1910, 1, 505—508. *J. Chem. Soc.*, 1910, 110, ii., 449.

THE peat (5 grms.) is ignited in a quartz dish, the ash digested with *aqua regia*, evaporated to dryness, extracted with dilute acid, filtered, and made up to 500 c.c. Of this solution, 100 c.c. is treated with ammonia to precipitate the iron and aluminium, boiled, and precipitated with 18 c.c. of a saturated solution of ammonium oxalate. After boiling for two minutes, the solution is left for at least three hours, filtered, and the precipitate washed. The precipitate is transferred to a beaker, the filter being washed with hot sulphuric acid, and after adding 10 c.c. of strong sulphuric acid the solution is heated nearly to boiling and titrated with permanganate (1 c.c. = 0.001 grm. CaO). The method is not suitable for mineral soils.

*Cellulose in soils; Decomposition of* —. I. G. McBeth. *Soil Sci.*, 1910, 1, 437—487. *J. Chem. Soc.*, 1910, 110, i., 592.

TWENTY-FIVE species of cellulose-dissolving bacteria were grown on media containing cellulose prepared from lucerne flour, and all were found to dissolve the cellulose as readily as that prepared from filter paper. The organisms develop most readily in air; some growth can, however, be obtained under anaerobic conditions. Whilst most of them grow well on ordinary culture media, a few grow only in presence of cellulose. The organisms assimilate nitrogen both in inorganic and organic forms, peptone being the most favourable for the largest number of species, and casein usually the least favourable. With dextrose, lactose, maltose, sucrose, and starch, the amount of acid formed in twelve days at 30° C. is usually between 1 and 2% on Fuller's scale; in mannitol and glycerol solutions the acidity is usually less than 1%, and in some cases no acid is formed at all. Filamentous fungi are of greater importance in the destruction of cellulose in the humid soils in the east of the United States than in the semi-arid soils of Southern California. In the latter soils the rapid destruction of cellulose is probably due to favourable conditions of climate and cultivation rather than to the specially active nature of the soil flora.

*Calcium and magnesium compounds; Influence of — on plant growth.* F. A. Wyatt. *J. Agric. Res.*, 1916, 6, 559—619.

THE investigation consisted in tracing the influence of calcium and magnesium, both in naturally occurring and in artificially prepared compounds upon the growth of wheat, soya beans, alfalfa, and

cowpeas, in cultures of sand or of a brown silt loam. The experiments were conducted in earthenware pots and extended over three years. Extraction of the sand with acid did not remove all the calcium and magnesium contained in it, and the plants showed a marked power of absorbing the residual elements, even after the sand had been extracted with fairly concentrated hydrochloric acid for 9–14 days, or on a steam bath for 4 days. A nutrient solution containing potassium sulphate (50 grms. to 2.5 litres), ammonium nitrate (80 grms. to 2.5 litres), disodium phosphate (26.1 grms. to 2.5 litres), and ferric chloride (0.4 grm. per litre) was applied at intervals. Dolomite, limestone, magnesite, calcareous soils, and brown silt loam were used as natural sources of the metals, and the artificial compounds employed were the carbonates, chlorides, and sulphates. The crop yields and the ratio of calcium to magnesium in the plants, bore no direct relation to the ratio of the metals when applied as natural carbonates; and widely varying ratios of the metals produced no corresponding differences in the yields. There was a tendency for the plants to absorb relatively more magnesium than calcium, but the absorption of both increased with the amounts applied. A dressing of 40% of dolomite had a favourable effect upon the plants, and all of them grew well in a mixture of 96% dolomite and 4% sand, in 7% magnesite and 93% sand, and in 100% magnesian limestone. It was, however, noted that a high percentage, e.g., 35%, of magnesium caused a certain amount of sickness, manifested by a yellowing of the top leaves: such plants always showed a high magnesium content. Alfalfa was found to absorb more calcium and magnesium than wheat. Pure, artificial magnesium carbonate ( $Mg(OH)_2 \cdot 4MgCO_3$ ) was toxic when applied in amounts greater than 0.7% to brown silt loam, and in sand 0.35% sufficed to inhibit the growth of all the plants tested. This carbonate gave an immediate alkaline reaction with phenolphthalein, whereas the magnesite and calcareous soils gave it only after standing in water for 8–12 hours. On wheat and soya beans, with a magnesium-calcium ratio of 4:5, 0.1% of magnesium applied as artificial carbonate prevented germination or stopped growth, but chloride and sulphate in the same amount were far less harmful: the chloride was less detrimental than the sulphate. On the other hand with 0.01 and 0.001% of magnesium, the carbonate gave the best result and the chloride the worst. In general, the smaller the amount of artificial compound, the better the development of both plant and root. The plant seeds contained more magnesium than calcium, but in the plant itself there was a preponderance of calcium.

—E. H. T.

*Dicyanodiamide; Determination of — in nitrolim (crude calcium cyanamide) by Caro's method.*  
G. Hager and J. Kern. *Z. angew. Chem.*, 1916, 29, 309–312.

CARO's method for the determination of dicyanodiamide in nitrolim (this J., 1911, 23) gives low results, particularly when a comparatively high percentage of this substance is present. The source of the error is twofold. In the first place a certain small quantity of dicyanodiamide is always carried down with the silver cyanamide precipitate, even in presence of an excess of ammonia, and secondly, after filtering off this precipitate, some decomposition, resulting in the evolution of ammonia, occurs when the filtrate containing silver dicyanodiamide is boiled with potassium hydroxide in order to reprecipitate the dissolved silver salt. Both of these errors obviously lead to low values for the dicyanodiamide nitrogen in the subsequent Kjeldahl

determination, and no method was found whereby they could be obviated.—G. F. M.

*Mineral phosphates; Solubility of mineral —.*  
A. Aita. *Annali Chim. Appl.*, 1916, 6, 28–44.

EXPERIMENTS on successive extractions of mineral phosphates, raw and calcined, with 2% citric acid solution, gave results similar to those obtained by Robertson (this J., 1914, 9; 1916, 217). The solubility is diminished by addition of calcium salts but increased by addition of ammonium, potassium, sodium, and magnesium salts; the increase is greater with sulphates than with nitrates, and least with chlorides. It is considered that the solubility of so-called basic phosphates of the Wiborg phosphate type is due to the presence of alkali salts and not to the formation of a tetra-calcium-alkali phosphate.—A. S.

#### PATENTS.

*Fertiliser [ammonium metaphosphate]: Process for preparing a concentrated —.* W. H. Ross, A. R. Merz, and J. N. Carothers, Washington, D.C. U.S. Pat. 1,194,077, Aug. 8, 1916. Date of appl., May 20, 1916. (Dedicated to the public.)

PHOSPHATE rock, etc., is decomposed by heat according to the volatilisation method, and the resulting vapour of phosphoric anhydride brought into contact with gaseous ammonia and water vapour. The product is condensed by cooling and collected in the dry state.—W. E. F. P.

*Fertiliser [phosphate]: Process of making —.* S. B. Newberry, Sandusky, Ohio, and G. R. Fishburne, Charleston, S.C. U.S. Pat. 1,194,219, Aug. 8, 1916. Date of appl., Mar. 30, 1910.

In a process for making citrate-soluble phosphate, finely-divided, insoluble phosphate—either alone or mixed with an alkali metal compound—is heated in an inclined, rotary cylinder through which hot furnace gases are passed. In the latter case the heating is carried to fusion or semi-fusion, the product being re-ground for use, and the gases treated with a spray before discharge.—W. E. F. P.

#### XVII.—SUGARS; STARCHES; GUMS.

*Sugar content of beetroots: effect of removing the leaves.* O. Munerati, G. Mezzadri, and T. V. Zapparoli. *Staz. Sperim. Agrar. Ital.*, 1915, 48, 743. *Annali Chim. Appl.*, 1916, 6, 46–47.

Two series of tests were made to ascertain the effect of removing the leaves on single beetroots. In one series the root was not removed from the soil between the first and second analysis, whilst in the other a root was pulled up, its weight determined and a sample taken for the sugar determination, after which the root was re-planted and, after some time, again pulled up, weighed, and analysed. In the case of the roots not removed from the soil, those from which the leaves were removed showed a progressively diminishing content of sugar, whilst in those from which the leaves were not removed, the sugar content increased progressively. In the case of the roots which were transplanted, the weight increased continuously in proportion to the development of new foliage; when the leaves were removed the weight either remained constant or diminished. The percentage of sugar progressively diminished in the roots from which the leaves were stripped, whilst in those retaining their foliage, the percentage of sugar showed first a slight reduction, corresponding to the production of new leaves, and then remained almost constant or, in some cases, increased.—A. S.

## XVIII.—FERMENTATION INDUSTRIES.

*Pomace wines: their composition and detection.*  
J. R. Eoff, jun. J. Ind. Eng. Chem., 1916, 8, 723—726.

ANALYSES of a number of pomace wines are tabulated, together with analyses of two genuine wines for comparison, and the differences in composition are discussed in so far as they afford means of distinguishing genuine wines from pomace wines.

—A. S.

*Colorimetric determination of the hydrogen ion concentration of bacteriological culture media.*  
Clark and Lubs. See XXIII.

## PATENTS.

*Distillery-slop; Manufacture of by-products from*  
—A. von Lászlóffy, Peoria, Ill. U.S. Pat. 1,193,651. Aug. 8, 1916. Date of appl., Mar. 27, 1911.

The liquid portion separated from distillery-slop is freed from water and treated with a solvent which extracts the lactic acid, succinic acid, fat, and glycerol, the latter being but slightly soluble in the solvent employed. These substances are then separated from one another by utilising the differences in their solubilities in the solvent.

—W. P. S.

*Wines and the like; Process for maturing, purifying, and sterilising* —C. Henry, Coze, France. Eng. Pat. 17,400, May 7, 1914.

SEE Addition of Mar. 16, 1914, to Fr. Pat. 459,141 of 1912; this J., 1916, 64.

to 1.83976 units and each 1 lb. of fat to 4.21848 units.

Food.	Quantity.	Energy value.
Wheat, flour, and meal ..	Cwts. 79,849,028	K.-L. calories. 14,539,234,192
Oatmeal .....	1,970,094	409,997,460
Rice .....	1,780,000	324,956,800
Barley .....	3,000,000	537,520,000
Indian meal .....	3,000,000	519,120,000
Other farinaceous products .....	1,302,724	198,500,000
(Total cereals) .....	(90,902,746)	(16,529,418,461)
Potatoes .....	87,406,723	3,649,500,490
Onions .....	2,808,033	54,582,382
Cabbage, sprouts, etc. ....	3,973,341	57,847,362
Root crops .....	8,803,455	141,800,565
Peas and beans .....	5,152,042	6,2,756,000
Tonatoes, etc. ....	2,063,837	29,197,498
(Total vegetables) .....	(110,783,640)	(4,336,494,297)
Beef and veal .....	21,138,675	2,198,670,233
Mutton and lamb .....	0,923,368	1,383,406,326
Pig meat .....	14,650,294	3,908,040,896
Poultry, game, and rabbits .....	2,098,591	250,653,013
"Oftal" and sausages .....	1,753,037	142,510,063
(Total meat) .....	(50,464,465)	(7,881,180,633)
Milk and cream (802,502,735 gds) .....	73,437,765	2,700,671,042
Condensed milk .....	1,113,082	181,920,648
Butter .....	5,524,700	2,230,652,872
Cheese .....	2,780,459	633,057,146
(Total dairy products) .....	(82,856,000)	(5,757,811,706)
Eggs .....	3,096,490	284,230,391
Lard and margarine .....	4,266,518	1,824,056,783
Fish .....	13,284,332	331,774,867
Sugar and molasses .....	31,903,753	6,462,974,530
Fruit, fresh .....	22,854,401	507,342,464
Cocoa and chocolate .....	549,030	142,788,059
Fruit, preserved, and nuts .....	3,057,879	458,507,190
Olive oil .....	82,800	37,318,976
Total .....	415,002,085	44,820,291,359

—W. P. S.

*Pentose and the so-called furfuroids.* E. Kunz. Biochem. Zeits., 1916, 74, 312—339. J. Chem. Soc., 1916, 110, 1, 590.

The chaff investigated contains two kinds of substances which yield furfural, one of which can be readily hydrolysed, whereas the other cannot. An approximate separation of the two can be accomplished by heating for several hours with 2% sulphuric acid. The soluble product formed by this treatment, is arabinose, and the parent-substance must therefore be regarded as a genuine pentosan. The residue is very resistant to the action of dilute acids, and can be best degraded by the action of 1% sulphuric acid under a pressure of 3—4 atmospheres. Under these conditions about 90% of the residue is rendered soluble. Various reactions indicate that the dissolved substance in this case also is arabinose, and the mother substance some kind of a pentosan. The conclusion is drawn that substances described as furfuroles, contrary to what has sometimes been suggested, probably also contain a pentosan complex; there is no evidence, according to the author, that they contain a methylene ether complex.

*Treatment and utilisation of sulphite-cellulose waste fibres.* König. See V.

## PATENTS.

*Food for infants and process of making same.* E. J. and D. N. Quertier, Fordingbridge, Hants. Eng. Pat. 100,898, Jan. 28, 1916. (Appl. No. 1339 of 1916.)

A MIXTURE of cows' milk, 100 parts, and a quantity of cream sufficient to introduce 30 parts by weight of fat, is dried at 212° F. (100° C.) on a revolving

—A. S.

*Food value of Great Britain's food supply.* W. H. Thompson. Economic Proc. Roy. Dublin Soc., 1910, 2, 168—220.

A SYNOPSIS of the food supply for the year 1908, compiled from various official sources, and its energy value, is given in the following table. The energy value is represented in kilo-litre calories (the unit being the heat required to raise 1000 litres of water from 15° C. to 16° C.). On this scale, each 1 lb. of protein or carbohydrate is equivalent

cylinder, and to the resulting powder is added 70 parts by weight of lactose.—W. P. S.

*Solids [milk powder] from liquids; Process for obtaining —.* J. S. and O. E. Merrell, Assignors to Merrell-Soule Co., Syracuse, N.Y. U.S. Pat. 1,193,173, Aug. 1, 1916. Date of appl., Jan. 18, 1916.

A PORTION of the water is removed from the milk by evaporation, and the condensed milk so obtained is sprayed into a chamber along with a current of dry air. The particles of milk are kept in suspension in the current of air sufficiently long to ensure that the whole of the water is vaporised. The desiccated milk powder falls to the bottom of the chamber and is removed by a rotary valve.

—W. H. C.

*Food [milk] product and method of producing the same.* R. W. Crary, Waukesha, and S. R. Barnett, Albany, Assignors to Crary Brokerage Co., Waukesha, Wis. U.S. Pat. 1,193,477, Aug. 1, 1916. Date of appl., Apr. 14, 1916.

COCONUT oil, free from fatty acids, is added to concentrated skimmed milk, and the mixture is homogenised.—W. P. S.

*Soy-bean products and method of preparation.* J. Friedman, Chicago, Ill. U.S. Pat. 1,194,495, Aug. 15, 1916. Date of appl., Dec. 17, 1914.

SEE Eng. Pat. 121 of 1914; this J., 1915, 148.

#### XIXB.—WATER PURIFICATION; SANITATION.

*Total hardness [of water]; Determination of — by means of potassium palmitate.* M. Tilgner. Chem.-Zeit., 1916, 40, 675.

In Blacher's method (this J., 1912, 555) the temporary hardness is determined by means of hydrochloric acid and the residual carbon dioxide expelled by a current of air. As it is difficult to ascertain when the expulsion of the carbon dioxide is complete, it is preferable to neutralise the free carbon dioxide with  $N/10$  potassium hydroxide solution, with phenolphthalein as indicator, prior to titration with potassium palmitate solution.—C. A. M.

*Chlorine in town water supplies; Detection of free —.* G. A. Le Roy. Comptes rend., 1916, 163, 228—228. (See this J., 1916, 378.)

VERY minute traces of free chlorine can be detected and the amount roughly estimated by the addition of a few drops of a solution of hexamethyltri-*p*-aminotriphenylmethane; a violet coloration, which varies in intensity according to the amount of free chlorine present, is immediately formed. The reagent is prepared by digesting 1 part of the organic compound in about 10 parts of diluted hydrochloric acid (1:1), and making up to 100 parts with distilled water. As an opalescence is produced with some waters, it is advisable to add a little formic or acetic acid, to prevent its appearance. The reagent is stable towards water, reacts extremely slowly with nitrates, and is quite unaffected by hydrogen peroxide. With its aid, 3 parts of chlorine in 100 millions can be detected: the limit of the starch-iodide reagent is 1 part in 10 millions.

—E. H. T.

*Composition and solubility of calcium acid carbonate.* Cavazzi. See VII.

#### PATENTS.

*Fluids; Apparatus for the sterilisation of — by ultra-violet rays.* M. von Recklinghausen, Assignor to The R. U. V. Co., New York. U.S. Pat. 1,193,209, Aug. 1, 1916. Date of appl., Mar. 14, 1914.

THE liquid is caused to flow over the corrugated walls of a pivoted receptacle which contains a mercury vapour lamp. A trap at the bottom of the receptacle retains a portion of the liquid while the lamp is in operation, and the lamp is partly submerged in this liquid. An electric magnet in the circuit holds the receptacle in position when the lamp is in operation but allows the receptacle to tilt and discharge the contents of the trap when the current is interrupted.—W. P. S.

*Grease or oil; Process for reducing matter [garbage, etc.] containing —.* C. S. Wheelwright, Providence, R.I. U.S. Pat. 1,193,743, Aug. 8, 1916. Date of appl., May 14, 1912.

GARBAGE, offal, or the like is heated in a suitable container and the oil which separates is removed; the heated material is then freed from rubbish, and mixed with hot spent liquid so as to form a pulp, which is heated and allowed to settle in a tank. Oil or grease is drawn off from the tank and the solid material and clear liquid are separated, the former being dried and the latter evaporated.

—W. P. S.

*Sewage and the like; [Electrolytic] method of purifying —.* D. T. Dobyns and J. K. Elderkin, jun., Newark, N.J., Assignors to Clark Process Corporation. U.S. Pat. 1,194,000, Aug. 8, 1910. Date of appl., Dec. 22, 1915.

SOLIDS are removed from sewage and the liquid portion is subjected to electrolysis; the solids are mixed with a substance which, under electrolytic action, will produce a germicide (nascent oxygen), and the mixture is also subjected to electrolysis.

—W. P. S.

*Sterilising liquids by means of ultra-violet rays; Apparatus for —.* V. Henri, Paris, and A. Helbronner and M. von Recklinghausen, Suresnes, France, Assignors to The R.U.V. Co., Inc. U.S. Pat. 1,193,143, Aug. 1, 1916. Date of appl., Feb. 12, 1914.

SEE Eng. Pat. 14,128 of 1910; this J., 1911, 131.

*Purifying liquids [sewage, etc.]; Process for —.* T. W. Barber, London. U.S. Pat. 1,194,933, Aug. 15, 1916. Date of appl., May 11, 1916.

SEE Eng. Pat. 6735 of 1915; this J., 1916, 555.

*Sewage; Apparatus for introducing gases into intimate contact with liquid —.* G. W. Mottram, Deepcar. U.S. Pat. 1,195,067, Aug. 15, 1916. Date of appl., Feb. 17, 1916.

SEE Eng. Pat. 2421 of 1915; this J., 1916, 434.

*Process of producing chromium-containing [base-exchanging] silicates. Process of base-exchange. [Purification of water.]* U.S. Pats. 1,193,794 and 1,193,795. See VII.

#### XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

*Digitalis standardisation. Physiological evaluation of fat-free digitalis and commercial digitalin.* G. B. Roth. U.S. Public Health Service, Hygienic Laboratory Bull. No. 102, 1916, 1—35.

THE one-hour frog method (the aim of which is

to determine the quantity of digitalis which will produce permanent systole of the ventricle, after one hour, when injected into the ventral lymph sac was investigated. Absorption from the lymph system was variable and depended partly on the temperature at which the animals were maintained during the experiments. At 10° C., the toxicity of certain digitalis glucosides was much less than at 20° C. The use of a suitable biological method and the adoption of a standard of activity by manufacturers are suggested as means whereby greater uniformity may be expected in the activity of commercial preparations of digitalis. By the one-hour frog method a variation of over 250% was found in 13 samples of commercial fat-free digitalis and of 159% in 5 samples of commercial digitalin. There was practically no difference in absorability of the fat-free tincture and the official (U.S.) tincture from the lymph system of the frog. Certain samples of fat-free digitalis exhibited deterioration after being kept for seven months, and it is suggested that such preparations should bear the date of their manufacture.—W. P. S.

*Colchicine; Pure*.—E. Merck. *Apoth.-Zeit. Chem. and Drug.*, 1916, 38, 946.

PURE colchicine is an almost white, amorphous and inodorous substance which has no sharp melting point. After drying over sulphuric acid, it becomes soft when heated to 142° C. and melts at 147° C. It is soluble in water, alcohol, chloroform, and benzene, and nearly insoluble in ether. From its solution in 3 parts of water, crystals of  $C_{12}H_{14}NO_6 \cdot 14H_2O$  separate on standing. Crystalline compounds of colchicine with chloroform and with ether are also described. The compound with 14—16% of chloroform is being put on the market.

*Vanilla extract*.—J. R. Dean and J. O. Schlotterbeck. *J. Ind. Eng. Chem.*, 1916, 8, 607—614, 703—709.

THE following conclusions have been drawn partly from experimental results and partly from the experiences of manufacturers of vanilla extracts. For the preparation of the extract the beans should be chopped and not ground. The beans can be dried without material loss of flavour in a slow current of air at the ordinary temperature, and the dried beans yield extracts having higher colour values and lead number values (see Winton and Lott, this J., 1910, 1268) than extracts made from undried beans. The colour value of the extract increases slightly and the lead number decreases slightly as the concentration of the alcohol used as solvent is increased up to about 65%. Extracts made with 60% alcohol are superior in flavour to those made with 50% alcohol; when undried beans are used, the effect of the water present upon the alcohol concentration should be taken into account. Extracts of the highest quality can be obtained only by long maceration at the ordinary temperature. Addition of alkali to the alcohol impairs the flavour of the extract, but addition of glycerol tends to give a deeper colour; sugar has no appreciable effect on the colour and should be added to the extract, not to the alcohol. The resins present in the beans are of no value as flavouring agents, but act as fixatives for the flavouring and colouring substances in the extract. The extract should not be left in contact with any metal that is not completely covered with tin. It is improved by ageing, which should extend over at least one year and be carried out in uncoated, porous, wooden vessels at the ordinary temperature.—A. S.

*Caffeine, acetanilide, antipyrine, phenacetin, salol, quinine, etc.; Analysis of mixtures of*—  
W. O. Emery. *J. Assoc. Off. Agric. Chem.*, 1916, 2, 59—75.

At the thirty-first Annual Convention of the Association of Official Agricultural Chemists, U.S.A., the following methods proposed by Emery and others were adopted as official. *Caffeine and acetanilide*. If the mixture is in powder form, the caffeine and acetanilide are extracted with chloroform; when dealing with pills or tablets, or when the caffeine is present as citrate, water should be added previous to the extraction with chloroform. In the case of a dilute alcoholic solution of the two substances, a portion of the sample is heated to expel the alcohol, the residual solution then treated with a small quantity of sodium bicarbonate and one drop of acetic anhydride, and extracted with chloroform. Should other alkaloids be present, the solution, after the acetylation, must be acidified with sulphuric acid. The chloroform solution containing the caffeine and acetanilide is evaporated to 10 c.c., 10 c.c. of dilute sulphuric acid (1:10) is added, the mixture evaporated to 5 c.c., 10 c.c. of water is added, and the mixture again evaporated to 5 c.c. The acetanilide is thus converted into aniline sulphate and acetic acid, from which the caffeine may be readily separated by means of chloroform. After removal of the caffeine, the acid aqueous solution is heated to expel all chloroform, then treated with 10 c.c. of concentrated hydrochloric acid, and titrated with standardised bromine solution (1 c.c. of which is equivalent to 5—10 mgms. of acetanilide). *Caffeine and phenacetin*. The same method of separation is employed as in the case of caffeine and acetanilide; after the hydrolysis with sulphuric acid, the caffeine is extracted with chloroform and the phenetidine sulphate remaining in the solution is re-converted into phenacetin by treatment with sodium bicarbonate and acetic anhydride (see Emery, Spencer, and Le Febvre, this J., 1915, 921). *Caffeine and antipyrine*. The method is that described by Emery and Palkin (this J., 1915, 733). *Acetanilide and phenacetin. Phenacetin and salol*. These substances are separated and determined according to the methods proposed by Emery, Spencer, and Le Febvre (this J., 1914, 887; 1915, 921). *Acetanilide and sodium salicylate*. The solution of the two substances is treated with sodium bicarbonate, the acetanilide extracted with chloroform, hydrolysed with sulphuric acid, and the resulting aniline sulphate titrated with bromine solution (see above). The aqueous solution containing the sodium salicylate is then acidified with hydrochloric acid, the salicylic acid extracted with chloroform, and the chloroform solution next extracted with sodium carbonate solution. This aqueous solution is heated nearly to boiling, an excess of N/5 iodine solution is added, the mixture heated for 30 minutes, the excess of iodine then destroyed by the addition of thiosulphate solution, the precipitate collected on a filter, washed with water, dried at 100° C., and weighed. The weight of the precipitate multiplied by 0.4658 gives the amount of sodium salicylate. *Caffeine, acetanilide, and quinine sulphate*. The method depends on the fact that quinine bisulphate is insoluble in chloroform, whilst caffeine and acetanilide are readily extracted by this solvent from a sulphuric acid solution. After the caffeine and acetanilide have been thus extracted, the acid aqueous solution is treated with an excess of sodium bicarbonate, the quinine is extracted with chloroform, the chloroform solution evaporated, the residue dissolved in alcohol, and the solution titrated with N/50 hydrochloric acid, using methyl red as indicator. Each c.c. of N/50 hydrochloric acid is equivalent to 8.86 mgms. of quinine sulphate. *Caffeine*,

acetanilide, and codeine sulphate. The method is similar in every way to that prescribed for caffeine, acetanilide, and quinine, except that in the case of codeine the alkaloid may be weighed before titration. *Caffeine, acetanilide, quinine sulphate, and morphine sulphate.* The two alkaloids are separated from the caffeine and acetanilide by extracting the two latter with chloroform from an acid solution; the separation of quinine from morphine depends on the fact that morphine, when treated with an excess of sodium hydroxide, yields a morphinate which is insoluble in chloroform. The acid aqueous solution containing the two alkaloids is treated with 5 c.c. of 10% sodium hydroxide solution, the quinine then extracted with chloroform and titrated after evaporation of the solvent. To the alkaline solution containing the morphine is added 0.5 grm. of ammonium chloride, and the alkaloid is extracted with chloroform containing 10% of alcohol. After the solvent has been evaporated, the residue of morphine is dried, weighed, and then titrated with *N*/50 sulphuric acid, using methyl red as the indicator; each c.c. of *N*/50 acid is equivalent to 7.53 mgrms. of morphine sulphate. *Tragacanth.* The method is that proposed by Emery (this J., 1912, 552).—W. P. S.

*Eucalyptus Australiana, Sp. Nov. ("Narrow-leaved peppermint") and its essential oil.* R. T. Baker and H. G. Smith. J. Roy. Soc. N.S.W., 1915, 49, 514—525. J. Chem. Soc., 1916, 110, i, 566.

THIS eucalyptus was originally regarded as a variety of *Eucalyptus amygdalina*, but further study has rendered it desirable to give it specific rank. It flourishes on the ranges of New South Wales and Victoria, in a region which has little agricultural value, and as it yields a large amount of a good oil, it is proposed to establish a permanent industry. The cineol present in the oil can be profitably concentrated by collecting the steam-distillate during the first hour separately. Such a fraction contains more than 70% of cineol, whereas the whole oil averages about 45%. Moreover, this portion is almost colourless, and contains mere traces of aldehydes, so that it is pure enough for pharmaceutical purposes, whilst the yield is as great as that of the whole oil in most of the other eucalypts. The phellandrene portions which collect more particularly in the later distillates appear to contain an alcohol,  $C_{10}H_{11},OH$ .

*Calycanthus occidentalis; Volatile oil of —.* C. C. Scallone. J. Ind. Eng. Chem., 1916, 8, 729—731.

THE shrub known as spice bush (*Calycanthus occidentalis*, *Butneria occidentalis*) grows in northern California and southern Oregon. On distilling with steam the leaves yielded 0.15% and the twigs 0.37% of a greenish-yellow oil, having a bitter taste and camphoraceous odour. The oil is soluble in all proportions in 90% alcohol and in 15—16 vols. of 70% alcohol by volume. It has sp.gr. 0.9295 at 20° C.; optical rotation, +7° 28';  $n_D^{20} = 1.4713$ ; acid value, 0.05; saponit. value, 54.3; acetyl value, 33.5. It contains about 60% of cineol, 8% of pinene (*d*-pinene with a small proportion of *l*-pinene), 9% of borneol, and 19% of linanyl acetate, together with small quantities of methyl salicylate, sesquiterpene-alcohols, and camphor.—A. S.

*Cinnamomum Oliveri (Bail.) or Brisbane sassafras; Essential oil of —.* G. W. Hargreaves. Chem. Soc. Trans., 1916, 109, 751—754.

THE bark of *Cinnamomum Oliveri* yields over 2% of volatile oil having sp.gr. 1.030, and  $n_D^{20} = 1.5165$ . Its chief constituents are pinene (12—15%), *d*-camphor (18—20%), safrole (25—27%), and eugenyl methyl ether (40—45%). The oil from

the leaves contains similar substances in the lower fractions but differs in the higher ones, no safrole or eugenyl methyl ether being present. The terpenes, amounting to about 25%, contain in addition to pinene a substance giving a nitrosite, possibly phellandrene. *d*-Camphor is present to the extent of about 60%, whilst the highest fraction (15%) consists of phenols and other substances.—G. F. M.

*Taurine.* P. Bergell. Z. physiol. Chem., 1916, 97, 260—263.

THE sodium salt of  $\beta$ -naphthalene sulphoamino-ethanesulphonic acid ( $\beta$ -naphthalenesulphotaurine) was prepared by the interaction of taurine in dilute sodium hydroxide solution with  $\beta$ -naphthalene-sulphochloride dissolved in ether. When these substances have been shaken together for many hours, and the aqueous liquid has been separated and treated with hydrochloric acid, the new compound can be salted out in a crystalline form by means of common salt or sodium sulphate. After boiling with 85% alcohol and re-crystallising, the new taurine derivative is obtained in long crystals of nacreous lustre, m.pt. 247° C. It is soluble in boiling water and in eight times its bulk of water at the ordinary temperature; it is less soluble in alcohol, soluble in carbon tetrachloride, but nearly insoluble in ethyl acetacetate, acetone, ether, and benzene. The above-mentioned reaction can be utilised to detect taurine in urine, and it may possibly serve to isolate that base from complex mixtures.—E. H. T.

*Hydrogen peroxide of crystallisation; Compounds containing —.* H. Stoltzenberg. Ber., 1916, 49, 1545—1546.

ATTEMPTS to prepare isomorphous substances containing hydrogen peroxide have not been successful; a mixture of isomorphous compounds would be more stable than the individual compounds. Urea-sodium chloride-hydrogen peroxide,  $CO(NH_2)_2 \cdot NaCl \cdot H_2O$ , biuret-hydrogen peroxide,  $(C_6H_5N_2O_2)_2 \cdot H_2O$ , alloxan-hydrogen peroxide,  $(C_6H_5N_2O_2)_2 \cdot H_2O_2$ , and allantoin-hydrogen peroxide,  $C_6H_5N_2O_4 \cdot 3H_2O$ , have been prepared. The amino group appears to play a part in combining with the hydrogen peroxide, as the alkylation or acetylation of urea decreases its ability to form such compounds. Parabanic acid and allantoin do not form hydrogen peroxide addition compounds.—F. W. A.

*Salicylates; Manufacture of — in Great Britain.* Chem. and Drug., Aug. 26, 1916.

THE manufacture of salicylic acid and its derivatives is becoming firmly established in Great Britain. There are now about a dozen firms engaged in the manufacture, and notwithstanding difficulties in obtaining engineering plant, the output is already almost sufficient to meet home demands and is rapidly increasing, especially as ample supplies of raw materials are now available. In the opinion of those engaged in the manufacture, some form of protection, if only temporary, will be necessary if the industry is to be permanently established in this country. It is suggested that assistance should be given for at least two years after the war, but opinion is divided as to the form the assistance should take.

*Determination of formic acid in pure solutions and in urine, together with a new method for the titration of calomel.* Riesser. See VII.

#### PATENTS.

*Cephaeline ethyl ether.* J. W. Meader, Indianapolis Ind., U.S.A. Eng. Pat. 11,718, Aug. 13, 1915.

THE ethyl ether of cephaeline, of the probab-

formula,  $C_{28}H_{34}O_3N_2OC_6H_5$ , is prepared by the action of an alkali metal and an ethyl halide on cephaeline. *Example.* 46.6 grms. of cephaeline and 4.6 grms. of sodium are dissolved in 400 c.c. of alcohol and the solution is boiled with 15 grms. of ethyl bromide under a reflux condenser for two hours. The alcohol is distilled off, and the residue dissolved in diluted hydrochloric acid, treated with ammonia, and extracted with ether. The ethereal solution is extracted with dilute caustic soda to remove unchanged cephaeline, and is then evaporated to dryness on the water-bath. Cephaeline ethyl ether is obtained as a varnish-like substance, easily soluble in alcohol, ether, and chloroform. It forms a crystalline hydrochloride (needles) and hydrobromide. The ether and its salts are valuable medicinal products.—F. Sp.

*Bromine[containing] solution.* J. Werner, New York. U.S. Pat. 1,183,055, May 16, 1916. Date of appl., July 1, 1913.

A BROMINE compound free from irritant properties and smell, but possessing the antiseptic and disinfectant properties of free bromine, is made by combining bromine with an acid containing the nucleus of trihydroxybenzoic acid dissolved in glycerin. *Example.* One part of bromine is added to  $2\frac{1}{2}$  parts of tannin dissolved in 10 parts of glycerin, and agitated in a closed vessel until all free bromine has disappeared.—F. Sp.

*Hog cholera antitoxin; Process of treating* —. J. Reichel, Philadelphia, and H. Werner, Glenolden, Assignors to H. K. Mulford Co., Philadelphia, Pa. U.S. Pat. 1,183,591, May 16, 1916. Date of appl., July 1, 1915.

The antitoxin of hog cholera, in the form of blood of hyperimmunised hogs, is freed from cells, cellular debris, haemoglobin, fibrin clots, and living and dead germs, without unduly diluting it, by treating it, preferably at the time of bleeding, with a saturated chemical reagent to prevent coagulation, e.g., saturated sodium citrate solution, and with an aldehyde solution, e.g., formaldehyde, to inhibit haemolysis. One litre of blood requires about 15 c.c. of saturated sodium citrate and 10 c.c. of 1% formaldehyde solution. After standing about 12 hours to allow the cellular elements to shrink and harden, the latter are separated, e.g., by centrifuging, and the serum is filtered through sterilising filters.—F. Sp.

*Hexamethylene[letr]amine and calcium chloride; Chemical compound of* — *and process relating to same.* E. Samson, Assignor to C. F. Stiefel, New York. U.S. Pat. 1,193,474, Aug. 1, 1916. Date of appl., Mar. 13, 1914.

CALCUTUM chloride and hexamethylenetetramine are dissolved separately in alcohol, and the solutions are mixed and allowed to crystallise. The product is a stable combination of the two substances, free from water of crystallisation, and capable of being made into tablets for medical use.—F. Sp.

*Anaesthetic bodies.* L. Thorp, Assignor to Parke, Davis, and Co., Detroit, Mich. U.S. Pat. 1,193,634, Aug. 8, 1916. Date of appl., Apr. 24, 1916.

THE mono salts of esters of 1,3-tetra-alkyldiamino-2-hydroxypropane behave as local anaesthetics, in particular the monohydrochloride of the benzoic ester of 1,3-tetra-ethyldiamino-2-hydroxypropane, a colourless crystalline body of m.pt. 130° C., soluble in water and alcohol, very slightly soluble in ether or benzene, and faintly alkaline to litmus. When heated with hydrochloric acid or caustic soda solution, it yields benzoic acid and 1,3-tetra-ethyldiaminodihydroxypropane. Treated with potassium carbonate solution it gives the oily benzoic ester of 1,3-tetra-ethyldiaminodihydroxypropane.—F. Sp.

*Anaesthetic bodies and method of preparing the same. Anaesthetic bodies.* E. A. Wildman, New York, and L. Thorp, Assignors to Parke, Davis, and Co., Detroit, Mich. U.S. Pats. (A) 1,193,649, (B) 1,193,650, and (C) 1,193,651, Aug. 8, 1916. Date of appl., Apr. 17, 1916.

(A) THE salts of the aryl esters of  $\gamma$ -dialkylaminopropyl alcohols possess anaesthetic action, but only slight toxicity compared with cocaine. Particular claim is made to  $\gamma$ -diethylaminopropyl-cinnamate hydrochloride, prepared by treating  $\gamma$ -diethylaminopropyl alcohol dissolved in an inert solvent such as benzene, ether, or acetone, with the equivalent weight of cinnamoyl chloride, and filtering off the precipitate produced. The free base may be prepared by treating the hydrochloride with potassium carbonate solution. It is a colourless oil, readily soluble in alcohol, ether, or benzene, slightly soluble in water, alkaline to litmus, and hydrolysed by hydrochloric acid or caustic soda solution forming cinnamic acid and  $\gamma$ -diethylaminopropyl alcohol. The hydrochloride crystallises from a mixture of alcohol and ether in white needles, melting at 137° C. (B) The salts of the alkamine esters of anisic acid are claimed as local anaesthetics, particularly the hydrochloride of the  $\gamma$ -diethylaminopropyl ester of anisic acid. The free base is a colourless oil, slightly soluble in water, readily soluble in alcohol, ether, or benzene, alkaline to litmus, and hydrolysed by hydrochloric acid or caustic soda solution forming anisic acid and  $\gamma$ -diethylaminopropyl alcohol. The hydrochloride crystallises from a mixture of acetone and ether in white crystals melting at 129° C. (C) The salts of the alkamine esters of *p*-toluic acid are claimed as local anaesthetics, particularly the hydrochloride of the  $\gamma$ -diethylaminopropyl ester of *p*-toluic acid. The free base is a colourless oil, very slightly soluble in water, readily soluble in alcohol, ether, or benzene, alkaline to litmus, and hydrolysed by hydrochloric acid or caustic soda solution forming *p*-toluic acid and  $\gamma$ -diethylaminopropyl alcohol. The hydrochloride crystallises from a mixture of acetone and ether in white crystals.—F. Sp.

*Nitrile derivatives (oxamide); Electrolytic and saponifying process for producing* —. J. E. Bucher, Coventry, R.I. Assignor to Nitrogen Products Co., Providence, R.I. U.S. Pat. 1,194,354, Aug. 15, 1916. Date of appl., Feb. 23, 1915.

GASEOUS cyanogen is led under pressure into a bath of concentrated halogen acid, or other catalytic agent, which is stirred continuously and heated to the temperature most favourable to the formation of oxamide.—F. Sp.

*Dinitroalkylaminobenzenearsinic acids; Preparation of* —. C. F. Boehringer und Söhne, Mannheim-Waldhof. Ger. Pat. 292,516, Apr. 28, 1915. Addition to Ger. Pat. 235,604.

MONONITROALKYLAMINOBENZENFARSINIC acids or their 2-halogen derivatives, prepared as described in the chief patent (see Eng. Pat. 29,546 of 1913; this J., 1914, 806), are nitrated with the calculated quantity of nitric acid in presence of concentrated sulphuric acid.—A. S.

*Lecithin derivative containing iodine and iron; Preparation of a* —. H. Krift, Cologne. Ger. Pat. 292,961, Sept. 4, 1913.

A COMPOUND of therapeutic value, containing organically combined phosphorus, iron, iodine, and nitrogen, and resembling lecithin in character, is obtained by treating a saturated alcoholic solution of lecithin with alcoholic solutions of ferric chloride and iodine at 60° C.—A. S.

*Barbituric acid derivatives; Preparation of* —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 293,163, Feb. 12, 1915.

UNSYMMETRICAL disubstituted malonic acids of the general formula,  $R_1R_2C(COOH)_2$ , where  $R_1$  is an alkyl or aryl group, and  $R_2$  is an alicyclic radical or a secondary alkyl group of the isopropyl type, are converted into barbituric acid derivatives by the usual methods, or the second substitution may be introduced into a mono-substituted barbituric acid prepared from the corresponding malonic acid derivative or from barbituric acid, or into one of the intermediate products obtained in the preparation of the barbituric acid derivatives. Barbituric acid derivatives in which the carbon atom in the 5-position is attached to an alkyl or aryl group and to an alicyclic radical or an isopropyl or similar secondary alkyl group are less toxic and have a more powerful hypnotic action than other symmetrical and unsymmetrical disubstituted barbituric acids.—A. S.

## XXL—PHOTOGRAPHIC MATERIALS AND PROCESSES.

*Physical measurement of X-rays.* Bronson. See Cl. XXII.

### PATENT.

*Colour photography and cinematography.* F. W. Donisthorpe, Barnes. U.S. Pat. 1,198,879, Aug. 8, 1916. Date of appl., Mar. 26, 1914.

SEE Eng. Pat. 7368 of 1913; this J., 1914, 503.

## XXII.—EXPLOSIVES; MATCHES.

### PATENTS.

*Priming or detonating composition.* M. R. Swope, New York. U.S. Pat. 1,194,095, Aug. 8, 1916. Date of appl., Feb. 28, 1916.

The composition consists of compressed nitrocellulose or other nitrocarbohydrate, a thiocyanate, and a chlorate or other oxygen conveyor.—C. A. M.

*Explosive and method of manufacturing same.* G. Spica, Venice, Italy. U.S. Pat. 1,194,561, Aug. 15, 1916. Date of appl., June 4, 1914.

SEE Fr. Pat. 473,264 of 1914; this J., 1915, 576.

*Pyrotechnical composition; Process of making a* —. M. Magnard, New York. Re-issue No. 14,177, Aug. 1, 1916 (Date of appl., May 3, 1916), of U.S. Pat. 759,387, May 10, 1904.

SEE this J., 1904, 623.

## XXIII.—ANALYSIS.

*Indicators for the colorimetric determination of hydrogen ion concentration; Note on the sulphonephthaleins as* —. H. A. Lubs and W. M. Clark. J. Wash. Acad. Sci., 1916, 6, 481—483. (See this J., 1915, 1226.)

SOME slight modifications have been made in the methods of preparation of certain of the indicators previously described (*loc. cit.*). Dibromo-*o*-cresol-sulphonephthalein, prepared by bromination of *o*-cresol-sulphonephthalein in glacial acetic acid, promises to be useful. It changes from yellow to brilliant purple over a range of  $p_H = 5.2-6.8$ ; and a 0.04% aqueous solution of its monosodium salt is recommended for use. Thymolsulphonephthalein (*loc. cit.*) changes from red to yellow between  $p_H = 1.2$  and 2.8, and from yellow to blue between  $p_H = 8.0$  and 9.6.—J. H. L.

*Hydrogen ion concentration of bacteriological culture media; Colorimetric determination of the* —. W. M. Clark and H. A. Lubs. J. Wash. Acad. Sci., 1916, 6, 483—489. (See preceding abstract.)

FOR the rapid determination of hydrogen ion concentration in vegetable or animal extracts, etc., the authors recommend the series of indicators given in the table, covering a range of  $p_H = 1$  to 10 (i.e., from  $N/10$  acidity to faint alkalinity). The values of  $K$  in the table are the apparent dissociation constants determined by Salm's method (see this J., 1907, 842). In applying these indicators to the determination of hydrogen ion concentration in various vegetable and animal extracts, some deeply coloured, the authors obtained results rarely differing from the correct ones (found electrometrically) by more than  $p_H = 0.3$ , and usually the agreement was much closer than this. With coloured liquids the compensation method of Walpole (Biochem. J., 1910, 5, 207) is very useful, and in some cases dark liquids may be diluted five-fold or more without any serious change in the value of  $p_H$ . The confusing effect of turbidity is often more serious than that of colour. This is particularly the case when bromophenol blue and bromoresol purple are used. Both exhibit dichromatism, their solutions being red in thick layers but blue in thin layers (at the proper  $p_H$ ). It is therefore impossible with such indicators to establish a good comparison between a turbid liquid, which cannot be viewed

Chemical name of indicator.	Short name.	K as $p_H$ .	Useful range, $p_H$ .
Thymolsulphonephthalein (acid range) .....	Thymol blue	1.7	1.2-2.8
Tetrabromophenol-sulphonephthalein .....	Bromophenol blue	4.1	2.8-4.6
<i>o</i> -Carboxybenzene-azo- <i>di</i> -methylaniline .....	Methyl red	5.4	4.8-6.0
<i>o</i> -Carboxybenzene-azo- <i>di</i> -propylaniline .....	Propyl red	5.1	4.8-6.4
Dibromo- <i>o</i> -cresol-sulphonephthalein .....	Bromoresol purple	6.3	5.2-6.8
Dibromothymolsulphonephthalein .....	Bromothymol blue	7.0	6.0-7.6
Phenolsulphonephthalein .....	Phenol red	7.9	6.8-8.4
<i>o</i> -Cresolsulphonephthalein .....	Cresol red	8.3	7.2-8.8
Thymolsulphonephthalein (alkaline range) .....	Thymol blue	8.0	8.0-9.6
<i>o</i> -Cresolsulphonephthalein .....	Cresolphthalein	9.4	8.2-9.8

in any great depth, and a clear standard liquid of the same  $p_H$ . The authors obtained fairly good measurements with bromophenol blue, and excellent ones with bromoresol purple, by illuminating with a bank of ordinary electric lights screened by translucent paper coated with an acid solution of phenolsulphonephthalein to absorb the shorter waves. The reactions of most urines fall within the working range of bromoresol blue. Thymol blue, in its acid range (see preceding abstract), should be useful with vinegars and cultures of yeasts and moulds. The most trustworthy indicators of the series are phenol red and cresol red. Over the range of  $p_H$  which thymol blue has in common with phenolsulphonephthalein and cresolphthalein, the authors found the two-colour indicator more useful than either of the phthaleins; and generally they prefer two-colour indicators to one-colour indicators for the determination of hydrogen ion concentration.—J. H. L.

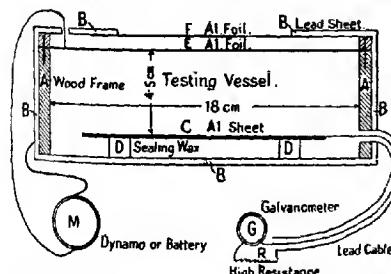
*Alkaline earths; Investigation of the "chromate method" for separating the* —. H. B. Vickery. Proc. Nova Scotian Inst. Sci., 1914—1915, 14, 30—40.

THE following procedure is recommended as the result of quantitative investigation:—(1) The

filtrate from the precipitation of the iron and zinc groups is boiled to remove hydrogen sulphide, evaporated to 60 c.c., 10 c.c. of ammonia (sp.gr. 0.90), 20 c.c. of ammonium chloride (10%), and 20 c.c. of ammonium carbonate (25%) solutions are added at 70° C. and the mixture allowed to stand for several minutes. The precipitation of strontium and calcium is complete in 10 mins. and that of barium very nearly so. If the temperature be much above 70° C. the precipitated carbonates are partly reconverted into chlorides by reaction with ammonium chloride; while below 70° C. calcium and barium are precipitated in more or less gelatinous form. (2) The mixed carbonates are dissolved in 5 c.c. of acetic acid (50%), the solution diluted to 80 c.c., heated to boiling, 5 c.c. of potassium chromate solution (5%) slowly added, with constant stirring, and the mixture boiled and filtered. 500 mgmms. of calcium and strontium fail to precipitate under these conditions, whereas 4 mgmms. of barium gives a distinct precipitate; the presence of barium in the latter is confirmed by the flame test. (3) The yellow filtrate is evaporated to 80 c.c., at least 80 c.c. of ammonium chloride (80 c.c. for every 200 mgmms. of calcium present) and 10–15 c.c. of ammonium sulphate (10%) solutions are added, the liquid boiled and allowed to stand for a few moments. The presence of strontium is indicated by a finely-granular, white precipitate and confirmed by boiling the latter with ammonium carbonate, neutralising the mixture with acetic acid, concentrating the solution to 10–20 c.c., and boiling with a saturated solution of calcium sulphate, when strontium sulphate is reprecipitated. If present to the extent of 100 mgmms. calcium is precipitated by ammonium sulphate as feathery, crystalline calcium sulphate unless a large excess of ammonium chloride is present; but the precipitation of strontium sulphate is inhibited to only a very slight extent by ammonium chloride. Under the above conditions 15 mgmms. of strontium may be readily detected in the presence of large amounts of calcium. (4) The hot filtrate from the ammonium sulphate treatment is made strongly alkaline with ammonia, 20 c.c. of hot ammonium oxalate solution (5%) is added, and the liquid stirred to precipitate calcium. By the above procedure 1 mgmms. of calcium may be readily detected in the presence of 400 mgmms. of barium and strontium.—W. E. F. P.

X-rays; Physical measurement of. H. L. Bronson. Proc. Nova Scotian Inst. Sci., 1914–1915, 14, 17–29.

The action of Roentgen rays on a photographic plate and on a Sabouraud pastille was found to be proportional to the ionisation produced in the air immediately surrounding them; and on this



principle a simple apparatus was devised for measuring the intensity and hardness of the rays. The apparatus (see fig.) consisted of a leaden case, connected with one terminal of a dynamo, M,

and having at the top a large opening closed by a sheet of aluminium foil, F, above which the X-ray tube was mounted at any desired distance. Below F was a second sheet of aluminium foil, E, insulated from the case and connected with the other terminal of the dynamo, the latter being any fairly steady source of potential high enough to produce practical saturation (at least 100 volts). The foil, F, was used to protect E from possible electrostatic action, and both were too thin to produce appreciable absorption of the X-rays. Within the leaden case was an aluminium plate, C, insulated by sealing wax, D, and connected with a galvanometer, G (for measuring the current due to the X-ray ionisation between E and C) by a small, lead-covered cable, the lead cover of which was connected through the high resistance, R, (a pencil line on ground glass) with one terminal of the galvanometer and the lead case, B, of the testing vessel. A milliammeter was used for measuring the current through the tube, but the spark gap was the only means available for measuring the potential; the current varied between 5 and 0.3 milliampères and the spark gap between 8 and 18 cm. Satisfactory results in determining the intensity and hardness of the rays and the times of exposure necessary for producing radiographs of suitable density were obtained by means of this apparatus.—W. E. F. P.

Graphic studies of ultimate analyses of coals. Ralston. See II.A.

Determination of formic acid in pure solutions and in urine, together with a new method for the titration of calomel. Riesser. See VII.

Determination of nitrous oxide, air, and water vapour in mixtures of these constituents. Burrell and Jones. See VII.

Practical methods for testing refractory firebricks. Nesbitt and Bell. See VIII.

Chemical examination of plaster. Cavazzi. See IX.

Determination of copper in low-grade ores and slags. Hawley. See X.

Electrometric determination of vanadium. Determination of chromium and vanadium in steel by electrometric titration. Kelley and Conant. See X.

Determination of tungsten and its separation from tin. Dittler and Von Graffenreid. See X.

Determination of the melting point of fats. Monhaupt. See XII.

Analysis of soap powders. Rosenberg and Lenher. See XII.

Colorimetric method for the detection of manganese in pigments, varnishes, etc. Sacher. See XIII.

Rapid method of estimating calcium oxide in peat soils. Gortner. See XVI.

Determination of dicyanodiamide in nitrolim (crude calcium cyanamide) by Caro's method. Hager and Kern. See XVI.

Determination of total hardness of water by means of potassium palmitate. Tilgner. See XIX.B.

Detection of free chlorine in town water supplies. Le Roy. See XIX.B.

Digitalis standardisation. Physiological evaluation of fat-free digitalis and commercial digitalin. Roth. See XX.

Analysis of mixtures of caffeine, acetanilide, antipyrine, phenacetin, salol, quinine, etc. Emery. See XX.

[Sept 30, 1916.

## PATENTS.

*Fluids; Apparatus for ascertaining the properties of* —. H. Carmichael, Malden, Mass., and W. M. Grosvenor, Ridgewood, N.J., Assignors to Perkins Glue Co. U.S. Pat. 1,192,861, Aug. 1, 1916. Date of appl., July 11, 1914.

THE apparatus consists of a rotatable, cylindrical vessel containing the fluid, in which a cylindrical body is suspended by a wire attached to a support above. The upper face of the cylindrical body has a deep recess, to the bottom of which the wire and an enclosing tube are attached; and means are provided on the exterior of the tube for measuring the effect produced on the suspended body by the rotation of the fluid in the container. —W. E. F. P.

*Pyrometer.* G. F. Machlet, Elizabeth, N.J. U.S. Pat. 1,193,011, Aug. 8, 1916. Date of appl., Aug. 28, 1910; renewed Feb. 17, 1916.

THE apparatus consists of a thermo-element partly enclosed by a heat-conducting sheath, the latter having a terminal nipple adapted to withstand high temperatures and being in contact with the thermo-element; a receptacle containing a heat-absorbing liquid which is directly in contact with and heated by the sheath; and means for constantly maintaining the liquid at its boiling point while subjected to the heating action of the sheath, so that a standard or normal temperature (much lower than that to which the nipple is actually exposed) is established for the thermo-element, and the sheath protected from injury by heat. —W. E. F. P.

*Method and means for testing paper pulp.* U.S. Pat. 1,193,613. See V.

## Trade Report.

*Prohibited exports.* Order in Council, Sept. 8, 1916.

THE following headings have been deleted from the list of prohibited exports (see this J., 1916, 620): (2) Waxes, mineral and vegetable (except carnauba), and composite waxes; (3) bleaching powder; brewers' dried yeast; egg, yolk and liquid, and albumen; strontium sulphate. The following headings have been added:—(1) Bleaching powder; iron wire; iron wire rods; leather, sole; (2) strontium sulphate; waxes, animal, mineral, and vegetable (except carnauba), and composite waxes; (3) albumen; gramophone record compositions; leather, not otherwise prohibited; egg, yolk and liquid; yeast.

## Export licences.

THE Foreign Office announce that no further export licences or other facilities will be given for the importation of the commodities shown below into the country named until further notice.

Denmark.—Borate of lime, borax, and boron compounds; sulphur.

Norway.—Borax and boron compounds; nickel; pitch.

Sweden.—Antimony; casein; rosin; turpentine.

Netherlands.—Nickel; pitch; sulphur; tar.

## Exportation of certain articles from France.

A DECREE of the French Minister of Finance, dated Aug. 23rd, provides that the following articles may be exported or re-exported from France without special authorisation, when con-

signed to the United Kingdom, the British Dominions, Colonies and Protectorates:—Acetones; animal wax, rough or worked; coffee extracts; menthol (essence of peppermint); monazite (ore of cerium, lanthanum, thorium); talc, steatite (tailors' chalk, Briançon chalk, etc.).

**AGRICULTURE IN INDIA.** By J. MACKENNA, Superintendent of Government Printing, Calcutta. 108 pages. Price 4 annas.

THE author gives a succinct account of the efforts which have been made to improve Indian Agriculture, and indicates the main lines on which the Agricultural Departments have been working since their reconstruction in 1905.

**TRANSACTIONS OF THE AMERICAN INSTITUTE OF METALS.** Vol. IX. Published by the Institute, Buffalo, N.Y., U.S.A.

THIS volume contains a report of the proceedings of the ninth Annual Meeting, held at Atlantic City from Sept. 28th to Oct. 1st, 1915. The majority of the papers have been abstracted in this Journal (1913, 1112; 1914, 966; 1915, 857, 1015, 1057, 1058, 1097, 1098).

**MINERAL RESOURCES OF THE UNITED STATES, 1914.** U.S. Geological Survey, Washington. Part I., Metals, 995 pages. Part II., Non-metals, 1122 pages.

**INDUSTRIAL GASES.** By G. MARTIN and others. Crosby, Lockwood & Son, 7, Stationers' Hall Court, London, E.C. 147 pages. Price 7s. 6d.

THIS is the seventh volume of the series of manuals of technological chemistry, edited by Dr. Martin. The chapter headings and contributors are as follows:—I. The liquefaction of gases, including the manufacture of oxygen, nitrogen, and hydrogen from liquefied gases (J. M. Dickson). II. Industrial oxygen (G. Martin). III. Industrial nitrogen (G. Martin). IV. Hydrogen (H. S. Redgrove). V. Producer-gas (H. S. Redgrove). VI. The carbon dioxide industry (H. S. Redgrove). VII. Manufacture of nitrous oxide (G. Martin). VIII. The ammonia and ammonium salts industry (G. Martin). IX. The manufacture of sulphur dioxide and sulphites (G. Martin). X. Acetylene (F. B. Gatehouse). XI. The illuminating gas industry (E. A. Lancaster). XII. Industrial ozone (E. Jobling).

**OCURRENCE OF EXPLOSIVE GASES IN COAL MINES.** By N. H. DARTON. U.S. Bureau of Mines, Bulletin 72. Government Printing Office, Washington. 248 pages. Price 35 cents.\*

THIS report gives the results of an investigation, started in 1907, of the origin of inflammable gases in coal and the conditions under which they occur. The fields examined were in the northern anthracite basin of Pennsylvania and in the southern part of the bituminous coal field of Illinois.

**ECONOMIC METHODS OF UTILISING WESTERN LIGNITES.** By E. J. BABCOCK. U.S. Bureau of Mines, Bulletin 80. Government Printing Office, Washington. 73 pages. Price 15 cents.\*

\* A certain number of these publications can be obtained free on application to the respective Government Departments.

In the case of the U.S. Government publications, when this supply is exhausted, copies can be obtained at the prices mentioned from the Superintendent of Documents, Washington, D.C., U.S.A.

